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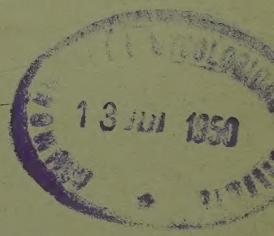
ANNUAL REPORT

OF THE

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

FOR

1948-49



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CHAPTER I.—ADMINISTRATION

General

This is the 19th Annual Report of the Indian Council of Agricultural Research covering the period from 1 April 1948 to 31 March 1949, presented by its Governing Body under Rule 64 of the Rules and Regulations of the Council.

Meetings

During the year the following meetings were held :

(i) Research Reorganization Committee, 16, 17 and 18 September 1948.

(ii) Scientific and Commodity Committees, October 1948.

(iii) Regionalization Committee, 11 January 1949.

(iv) Annual General Meeting, 12 January 1949.

(v) Advisory Board, 12 and 13 January 1949.

(vi) Standing Finance Committee, 28 January 1949.

(vii) Governing Body, 31 January and 1 February 1949.

During the year under review the Hon'ble Shri Jairamdas Daulatram, Minister for Food and Agriculture, continued to be the *ex-officio* Chairman of the Council and Sardar Datar Singh and Shri S. M. Srivastava were the Vice-Chairman and Secretary respectively. Sardar Datar Singh went to Australia as a member of the Indian Food Delegation in June 1948, and again as a delegate to the Session of the Food and Agriculture Organization of the United Nations, held in Washington in November 1948. Taking advantage of that opportunity, he also visited several other agricultural institutions in the U.S.A. to acquaint himself with the latest agricultural practices obtaining there so that those might be of benefit to this country.

Shri S. C. Sarkar, Under Secretary, Indian Council of Agricultural Research, who officiated as Secretary off and on, proceeded on six months leave preparatory to retirement on 6 December 1948 and was succeeded by Shri T. S. Krishnamurti, Secretary, Indian Central Tobacco Committee.

When the fodder famine broke out in Kutch, a centrally administered area, the officers of the Council especially, the Vice-Chairman, Sardar Datar Singh, took a prominent part in relief work, and in averting a catastrophe which would have otherwise resulted in a loss of a large number of cattle.

In addition to the Council's current schemes, numbering 117 on the Agricultural side, 115 on the Animal Husbandry side and 23 under Miscellaneous headings (total 255), 42 new schemes were sanctioned during the year at a total cost of about Rs. 11.8 lakhs (round) to the Council as detailed below :

Agricultural Schemes, 27

Animal Husbandry Schemes, 12

Other Schemes, 4

71 current schemes which were due to expire during the year were also extended for varying periods.

During the year under review, the following Unions were admitted as constituent members of the Indian Council of Agricultural Research *vice* the States of Gwalior and Patiala respectively, which had merged in those Unions :

(i) Madhya Bharat Union

(ii) Patiala and East Punjab States Union.

Finance and Accounts. The receipts from the cess levied under the Agricultural Produce Cess Act, 1940 and the grants received from the Government of India were as follows :

		Rs.
(i)	Receipts from the cess	17,16,650
(ii)	Grants for :—	
	(a) Provincial Marketing Scheme	53,000
	(b) Crop Cutting Experiments, Wheat and Paddy	2,64,700
	(c) Cereal Rust Scheme	14,650
	(d) Aerial Photography Scheme	2,520
	(e) Training of Ladies in Fruit Preservation	83,121
	(f) Indian Institute of Fruit Technology	1,66,000

A statement showing the audited accounts of the Council for the year 1948-49 is appended (Appendix).

CHAPTER II.—AGRICULTURAL RESEARCH

General

The seventh meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India was held in Rajaji Hall, Madras, from 7 to 10 April 1948. About a hundred delegates from all parts of the country attended the meeting. After the inaugural address on the first day by the Hon'ble Sri O. P. Ramaswamy Raddiar, Premier, Madras, the session split up into Committees to consider the different subjects on the agenda. The Committees met on 7 and 8 April and the full Wing on 9 and 10 April, to consider the reports of these Committees.

The following were the subjects considered by the Wing :

(1) (a) The need for breeding crop varieties adapted to varying levels of soil fertility and for special conditions of soil and climate.

(b) Review of the work done on the maintenance of soil fertility in India with suggestions for future lines of work with particular reference to the effect of soil fertility on the nutritive quality of food and fodder crops.

(2) The importance of root stocks in the standardization of fruit tree material.

(3) Cereal rusts and their control.

(4) Review of the comparative merits of different methods of improved farming practised in the country such as co-operative farming, collective farming, joint management, consolidation of holdings, etc. with particular reference to improvement in the yield of crops and economic condition of cultivators.

(5) Consequent on the division of the country, to consider measures to be taken, from the short-range and long-range points of view to maximize the production of food, particularly of cereals in India, so as to reduce her dependence on imports to the maximum extent possible, and to suggest five-year targets of increase in such production, for each unit of administration comprising India.

(6) To review the measures adopted to increase the fodder production by :

(a) selection and propagation of perennial cultivated grasses,

(b) improvement in rotational grazing, and,

(c) exploration of new fodder crops in addition to improving the existing ones.

(7) The rotation of crops which will give the best results in an irrigation of intensity varying from 35 to 70 acres out of 100 acres.

Some of the more important recommendations made are mentioned below :

(1) Cooking qualities should be kept in view while breeding new varieties.

(2) A rapid reconnaissance soil survey be undertaken for each province and State.

(3) A land use classification survey should be carried out to determine what areas are suitable for growing crops or trees or for pastures.

(4) Manurial schedules for the maintenance of soil fertility should be worked out, treating irrigated and rain-fed areas separately.

(5) Soil organic matter should form an important subject of investigation especially in relation to its effect on soil structure and microbiological activity.

(6) Registration of fruit nurseries should be deemed as a work of urgent importance, since on this depends the supply of reliable plants of intrinsically high performance.

(7) The Government may be requested to enact legislation of nursery-men enjoining that nurseries must conform to the standards as laid down in the preamble and no nursery-man could start a nursery unless it came to that standard.

(8) The scheme for suspending wheat cultivation in summer in parts of Peninsular India as recommended by Dr. Mehta should be given a trial.

(9) The plan of dusting sulphur as a fungicide against wheat rust should not only be carried out but similar other fungicides should also be tested.

(10) In each province and State there should be at least a reserve of 200 dusting machines and 20 to 30 tons of sulphur dust, for use against rust wherever epidemics are apprehended in order to save at least some wheat for seed purposes.

(11) A deputation consisting of two or three wheat investigators should be sent abroad for the collection of wheat samples resistant to rusts and other fungus diseases and other material which may be useful for genetic purposes.

(12) That a comprehensive propaganda for consolidation of holdings is vital to agricultural rehabilitation and that

the State should not hesitate to exercise a large measure of compulsion by legislation in this sphere. Suitable steps should also be taken by Provincial and State Governments to prevent fragmentation of holdings as far as possible.

(13) With a view to testing what is the best method of improving the social and economic conditions of the cultivators, a special officer should be appointed by the Central Government to prepare schemes for this purpose.

(14) The Provincial and Regional Boards for Land Utilization should be set up who should undertake a broad and rapid survey of the waste-lands in their jurisdiction, and classify these lands according to their possible use. The Board should also undertake a survey of sub-marginal lands with a view to retire such of these lands from agriculture as could be put to a more profitable use.

(15) Private enterprise in land utilization should be encouraged on a large scale by the grant of long-term leases and by subsidizing the purchase of necessary machinery and equipment required for reclamation and provision of irrigation.

(16) Greater emphasis should be laid on the more intensive use of organic manures such as farmyard manure, composts, oilcakes, green leaves and all waste products of agriculture. In order to conserve large supplies of farmyard manure, some of which is now being used as fuel, active measures should be taken for raising quick growing fuel trees such as casuarina, acacia, pines, *Prosopis juliflora*, *Leucaena glauca*, etc. wherever possible.

(17) Since multiplication and distribution of pure seeds of improved varieties of crops is one of the means of increasing food production, the Provincial and State Governments should have a target of seed production to cover ultimately with improved varieties of seeds at least 25 per cent of the area under each food grain annually.

(18) Intensive campaign should be carried out against the more serious pests and diseases for which it is essential that the Centre and every province, etc. should maintain adequate Plant Protection Organizations for watch and ward purposes, and that there should be close integration of plant protection programmes of various provinces, since a number of pests and diseases are seed or air-borne or are of a migratory nature.

(19) In each province and State, there should be an Agrostological Section to study the problem of fodder, etc. in all its aspects which will include : (a) collection of grasses (both indigenous and exotic), (b) their trial under local conditions, and (c) their cultural, manurial and hygienic requirements. The Central Government should help the provinces and States by collecting suitable forage plants and making those available for trial.

(20) The possibility of utilizing waste-lands in villages, field bunds and tank banks should be explored for growing suitable perennial and other fodder and forage plants. The attention of Irrigation Departments should be invited to the possibility of growing perennial grasses along irrigation channels.

(21) The system of rotational grazing, which has, with success been tried in some parts of India, should be extended to suitable forests and waste-lands in the provinces and States, and that the carrying capacity of such lands should be studied simultaneously. This work may be entrusted to the Land Utilization Board.

(22) Arrangements should be made for supplying to the cultivator seeds of recommended fodder crops, particularly *berseem*, which are not easily available. The possibility of utilizing bees for securing better setting of seeds in crops like *berseem* should be explored.

Rice

Breeding. The four rice breeding schemes in Bombay, Kashmir, Travancore and Hyderabad continued during the year. The Bombay rice breeding scheme, started in 1945, was in its fourth year of working. At Nawagam thirty superior progenies isolated during the previous year were subject to further trials. As a result of crossing between two F1s, strains of scented (Kamod and Basmati) and non-scented (Jirasal) varieties secured last year were studied in F2. The trials carried out of the improved strains from the Bombay province and outside indicate that while some of these strains gave higher yields over the local ones, none of them surpassed the locals in respect of both the important characters namely yield and grain quality. At Bulsar five improved strains from Karjat and five from Igatpuri were tried with local Kada and local Kolam but none of the outside strains was found to be superior to the local ones. The trials are being repeated for confirmation. In the spacing trials, the spacing 6 in. × 6 in. with eight seedlings per bunch gave the best results.

In the Kashmir scheme studies on exotic varieties were continued. Russian varieties have proved early maturing and were harvested about six weeks earlier than indigenous kinds. There are possibilities of growing this rice on high altitudes (7,000 ft. to 9,000 ft.) where no cereals but low yielding small millets are grown because of short season for plant growth. As in previous years the Chinese varieties of paddy gave very high outturn and eight best varieties giving yield of 5,000 lb. to 6,000 lb. per acre were multiplied and about 36,200 lb. of seed distributed to the cultivators for seed multiplication. As a result of three years' trials the cultivators are taking to these seeds voluntarily. Work is continuing.

Under the Travancore rice research scheme multiplication of the improved strains MO 1, MO 2, Ptb 10 was taken up during the year and about 5,000 lb. of seed prepared from the previous year's crop were distributed to seed growers for multiplication. Of the three improved strains MO 1 is salt resistant, MO 2 is suited to fields in the low level area which are not acidic or saline and Ptb 10 is suited to fields of a high level. The scheme terminated on 31 March 1949 and further multiplication and distribution will be done by the State Government.

The Hyderabad rice improvement scheme which was to terminate on 31 March 1949 had been extended. Experiments on the production of high yielding strains of five to six months duration and their manurial experiments are in progress under this scheme at Warangal. The primary purpose of the manurial experiment is to find out which combination of manures gives the maximum yield when applied to the two improved types HS1 late and HS35 very late. The experiments indicate that treatment with 45 lb. of nitrogen, 30 lb. of phosphate and 15 lb. potash tops the list for both the strains, HS1 and HS35, giving the maximum yield of 2209 lb. and 2809 lb. per acre respectively while 45 lb. of nitrogen, 30 lb. of phosphate and no potash comes the next best with an yield of 2,127 lb. and 2,536 lb. per acre respectively. The experiments are being repeated and final conclusions will be drawn next year.

Three new schemes on rice breeding were sanctioned during the year in East Punjab, West Bengal and Coorg. The partition of the country has affected the major rice growing area in Punjab and the rice farm at Kalashah Kaku where rice breeding was carried on had gone over to Pakistan. The Council has, therefore, sanctioned a scheme for rice breeding in East Punjab for evolving improved varieties to suit the plain tracts of the province covering an area of nearly three lakh acres under rice crop. The Coorg scheme aims at effecting improvements in the local rice types whose yield is already the highest in the whole of India. The West Bengal scheme aims at evolving improved varieties suited to the hilly and mountainous regions.

Pests and diseases. Under the paddy insect pests scheme in West Bengal, which was restarted after partition not much work was done during the year. In the scheme for the investigation of the 'blast'

and 'foot-rot' diseases of rice in Madras two resistant cultures 3840 and 3912 (crosses of Co4 with Adt10) which showed other desirable qualities also along with a fairly high yield record had been selected for distribution to *ryots* by the Madras Agricultural Department as 'blast' resistant types. Five years' experiments have shown that the foot-rot disease could be controlled completely by treatment with certain organo-mercury compounds like Ceresan and Agrosan, at the rate of one grain per pound of seed. An area of 1,750 acres was sown with seed treated with the fungicides and the disease was found to be completely absent in the treated area. The Madras Agricultural Department have included in their programme of work an organised campaign for the eradication of the disease by seed treatment in the districts of Coimbatore, West and East Godavari. The scheme has been given further extension for three years.

A new scheme for studying the *Helminthosporium* disease in paddy has been sanctioned in West Bengal.

The rice vernalization scheme run at the Calcutta University was closed on 31 March 1949. The results so far obtained indicate that the treatment stimulates the plants to increased production of sugar and absorption of total nitrogen and synthesis of protein. Short day treatment has been found to accelerate the flowering in *aman* varieties to about 90 days but in the case of summer (*aus*) varieties it delays flowering. Vernalization has brought about different responses with different treatments. Further work will now be done by the Central Rice Research Institute.

Wheat and Barley

Mention was made in the last report of the setting up of a High Power Wheat Rust Control Committee to co-ordinate the research work done on wheat rust by various agencies. A comprehensive scheme for research on wheat rust on an all-India basis prepared by this committee has been mostly approved by Government. The scheme is expected to be in operation shortly. The scheme envisages concerted measures to fight the rust menace both on long and short-term basis. The short-term project for eradicating the disease consists of two schemes. One of these is for giving a trial to a theory postulated by Dr. K. C. Mehta, of Agra University, to control rust in Peninsular India, including the Central Provinces, Bombay, Madras, Mysore and Travancore. Dr. Mehta's theory is that while the infection is killed in the plains by the intensive heat of summer, it is carried from season to season by the summer sowing of wheat and barley on the Nilgiri Hills. On this basis, he holds that, if the sowing of wheat and barley in summer is stopped in Peninsular India the menace will be mitigated to a large extent. The area which will go out of cultivation as a result will not exceed 4,000 acres. This portion of the scheme has been put in operation for a period of three years from the summer of 1948 and the provinces

and States concerned have banned by legislation the summer sowing of wheat and barley. The second scheme is to test how far the damage caused by rust can be minimized by sowing a mixture of those varieties of wheat seeds which are tolerably resistant to the black, brown and yellow varieties of rust individually. This scheme is to be tried for a period of five years with a view to saving at least a part of the crop. The scheme has not yet been put into operation.

The long-term project deals with the mycological, botanical and agronomical aspects of the problem.

Work under the various wheat rust schemes at Indian Agricultural Research Institute, Agra, Simla, Hoshangabad and Mahabaleshwar continued during the year. The main object of all these schemes is to breed varieties of wheat resistant to all the three forms of rust occurring in India. The Indian Agricultural Research Institute scheme aims at evolving rust-resistant types for growing in the hills. Bombay and C.P. schemes concentrate on testing the reactions of wheat against black stem rust in the seedling stage and to carry out tests for adult resistance in the field and breeding rust-resistant strains suited to the black soil areas, while fundamental work is being carried on at Agra. The first stage of work at the Indian Agricultural Research Institute, namely, breeding varieties individually resistant to each of the three rusts, has been successfully completed and varieties tolerably resistant to the three rusts have been evolved. The second and the more arduous phase of the problem, i.e. the synthesis of varieties, each resistant to all the three rusts, has recently been taken up. For this purpose crosses have been made on a large-scale and selections are being made on the basis of rust resistance and other agronomically desirable characters. During the year under report the cross was in F5 generation. As barley is also prone to attack by the black and yellow rusts attacking wheat, it becomes an alternate source of infection. Work is, therefore, being carried out for evolving resistant barley varieties.

At Mahabaleshwar rust reactions of wheat selections and hybrids, produced in Bombay, C.P., Institute of Plant Industry, Indore, and Hyderabad, were studied. In addition to Hofed 1, Kenya C 10854 and Kenya E 144 which have displayed satisfactory resistance to rust in previous years, two new wheat varieties from Australia, viz. Charter and Gabo have proved resistant to all the ten races in the seedling and adult stages, Kendee and Yalta. Out of the C.P. wheats the following varieties proved resistant, as in previous years, to the rust races maintained at Mahabaleshwar :

60 B—12 B—16 L, Bobin × (Bobin × Gaza), C 14112, E 220, Charter, Gabo, 192 Q Z A (L), C 9906, 291. J. 1. 1. 1. and Kenya E 144.

Satisfactory progress was maintained at Agra and Simla on the study of physiological races of rust attacking wheat and the maintenance of single spore cultures of different races. As in the last year no new race of any of the rusts was found during the year. Single spore

cultures of all the 27 physiological races were successfully maintained in the laboratory at Simla. No case of mutation in pathogenicity was noticed. A large number of promising varieties of barley was also tested for rust resistance to be used as breeding material for cultivation in the hills.

The work on all these rust schemes will merge in the co-ordinated all-India scheme when the latter starts functioning.

Maize

Recent scientific research in the U.S.A. on hybrid corn has revolutionized the production practices of the maize crop by increasing the yield considerably. The Council has also sanctioned a number of schemes in the major maize producing areas for research on similar lines. In addition to the two schemes which were in operation formerly at the Indian Agricultural Research Institute and East Punjab, a third scheme started working during the year in U.P. and two new schemes were sanctioned for Bihar and West Bengal. While the Indian Agricultural Research Institute scheme is concerned with fundamental geneticál research with a view to, (a) devise short cut methods for production of inbreds and, (b) conserve hybrid vigour induced in the first generation for two or more successive generations, the four provincial schemes deal with the immediate aspect of hybrid seed production for commercial utilization. The work in the East Punjab is in a fairly advanced stage and already a large number of inbred lines, developed from commercial varieties collected from all over India as well as abroad, are in hand. It is expected that some hybrid strains will be available for distribution in two or three years' time which will give higher yields than the local. The U.P. scheme has just started functioning and so have the Bihar and West Bengal schemes which began in April 1949.

Soyabeans

The soyabeans research scheme, sanctioned in the former Punjab, after temporarily being discontinued due to partition, continued to work during the year. The scheme envisages work on evolution and introduction of suitable varieties of soyabeans and study of the factors responsible for its successful cultivation and of possibilities of its use as human as well as cattle food. Experiments were carried out on sowing date, seed rate, spacing and method of sowing. It was found that the best time for sowing soyabeans crop at Ludhiana is between 25 June and 1 July. As regards ripening it was found that erect and compact varieties are early ripeners, erect and loose intermediate in maturity while the creeping ones were late ripeners. In chemical studies it was found that yellow seeded varieties possess higher percentage of protein and also had good cooking quality while black seeded ones have higher grain weight. Soyabeans should not be cooked like ordinary *dal* but after being wetted overnight The scheme is continuing.

The scheme for the biochemical assay of soyabeans at the Indian Institute of Science, Bangalore, was started during the year. Systematic investigations are being carried out on the nutritive and vitamin values of soyabeans as affected by variety and soil conditions. The results of first year's work indicate that differences in fat, protein and vitamin contents of various varieties are of considerable magnitude. Further investigations are in progress.

Pulses

Useful work was done under the co-ordinated scheme for research on pulses. At Madras certain improved strains have shown increased yields in varietal trials and a few selected types have reached multiplication stage. Out of these, culture No. 37 which has been consistent in giving the highest yield has been sent out for trial at 21 centres in the districts under field conditions. The results of two years mixed cropping experiments revealed that *arhar* mixed with a spreading variety of groundnut gave the maximum outturn per acre. In the United Provinces, types showing high yields and other characters have been selected. In some crops the work has reached a stage where strains can be multiplied and distributed to cultivators while in other breeding trials are still required to be carried out. Cooking tests were also conducted on the improved types. In *arhar*, strain 17/W/2 produced the best *dal*, T 66 ranked second while 56/W/1 was third. In *urad*, strain 12/5 was first for *dal*, the other two improved types, 8 B and M S/2/9, were only as good as the local. High yielding strains of *arhar* have been produced in Assam, e.g. R-3b with an yield of 912 lb. and R-7 with an yield of 658 lb. per acre against the mean yield of 572 lb. for all the strains tested. In Bihar higher yielding strains have been evolved and some of them have been finally selected for multiplication and distribution. Similarly in the C.P. high yielding strains have been evolved, e.g. No. 31 and Hyderabad P E in *tur*, Kopargaon in *mung*, No. 55 in *urad*, and No. 88 in *moth*. The Provincial Government are making arrangements for the multiplication and distribution of the improved varieties. In the Bombay scheme some of the improved strains tested for yield at Government farms gave almost double the yield of the local types. These will be tried in cultivator's fields next year.

A scheme for research on wilt disease which causes serious damage to the gram crop was in operation in the former Punjab. The scheme was temporarily suspended after partition but was started again. The results indicate that gram should not be sown in a mixed form but if that cannot be avoided then gram and wheat or gram and barley may be sown in alternate rows rather than in a mixed form. Experiments conducted for the fifth year in succession have failed to establish a pathogen as the cause of gram wilt as it occurs in the East Punjab. Non-biological agencies such as unfavourable soil conditions, deficient soil moistures and high temperature at the time of sowing are consi-

dered by the workers to be the main cause of wilt in gram. As this is a very important finding, the Council has set up a special expert Committee to study the problem on the spot and give its opinion.

A new scheme on pulse breeding has been sanctioned in West Bengal during the year.

The work on the physiology of pulse was in progress in the Presidency College, Calcutta. Investigations were undertaken on lentil, *moong* and gram. Varieties were obtained from Indian Agricultural Research Institute, U.P. and West Bengal and preliminary experiments were conducted on the course of water absorption, percentage of water at bursting of seed, behaviour of roots, stems, leaves and vernalization at low and high temperatures. Under the scheme for cytogenetical research on pulses at Annamalai University various species of *Phaseolus* were collected both from India and abroad and their chromosome numbers determined. The life history of *P. mungo* was completed and studies on hybridization work were undertaken. The scheme has been extended upto 31 March 1950.

Lesser Millets

The three main millets, which form the staple food of the people living outside the rice and wheat belts, cultivated in India are *jowar, bajra* and *ragi*. Schemes for the evolution of higher yielding strains of millets are in operation in Bombay, U.P., C.P., Baroda and Mysore. In Bombay two early selections of *nagli* (*Elusine coracana*) superior to the standard strain, B-11, are available. In *vari* (*Panicum miliacium*) two late improved strains have proved superior to the local. The scheme terminated on 31 March 1949. The Provincial Government will now arrange for the multiplication and distribution of the improved varieties. Similarly under the C.P. scheme improved high yielding strains of *kodo* and *kutki* have been evolved, i.e. *kodo* No. 13 and *kutki* No. 45 and the Provincial Government are arranging for seed multiplication and distribution. If the entire area of C.P. and Berar is sown with these improved varieties, it will result in an additional income of more than a crore of rupees. The Baroda scheme also came to a close during the year. Good selections have been obtained and seeds of promising types have been distributed for district trials. The U.P. and Mysore schemes are still continuing as final selections have not been made so far.

The *jowar* crop almost all over India is subject to the attack of a parasitic weed called *Striga* which sucks food material from the plant through the roots. The Council has been financing investigations on this problem in Bombay for the last ten years. The work has revealed that among the comparatively large numbers of *jowars* tested, there is to be found no complete immunity to *Striga* attack in any of them. Some useful preliminary results have, however, been obtained and it is hoped that during the next four years of its extension, financed

wholly by the Bombay Government, strains having all the economic characters and with a considerably high degree of resistance to *Striga* will be evolved.

A new scheme for the multiplication and distribution in bulk of hybrid *bajra* has been sanctioned in Madras. The scheme will start functioning from April 1950. More than a million pounds of hybrid seed are expected to be distributed for cultivation under the scheme.

Other Crops

The experiments on clove cultivation in Travancore State indicate the following results :

(a) shading is necessary. The seedlings raised with watering and heavy shading were found to be healthier and more vigorous, (b) viability of seeds is very low, (c) seedlings should be transplanted, (d) dibbling seeds deeper than one inch in the soil reduces the percentage of germination markedly.

Under the turmeric scheme in Orissa a local variety has been found to be the best yielder and *rudabathinga* (local) the second best and *jabedi* the third best. Of the three methods of processing tried, viz. local, Madras method and Assam method, the Madras method appears to increase the colour. Manurial experiments are also in progress.

A new scheme for research on turmeric has been sanctioned in Bombay.

Satisfactory work was done under the Madras cardamom scheme. A survey of the cardamom growing areas had been carried out and trials were undertaken of single plant selections for higher yield, better quality, etc. Two of these gave an increase of more than 100 per cent. Further trials are in progress. Control measures against 'thrips' which attack the cardamom plantations have been evolved. Nicotine sulphate as spray and Gammexene as dust prove both effective and economical. Further investigations are being carried out to find cheaper insecticides. Investigations on the nursery diseases indicate that they can be overcome to a large extent by providing an artificial shade for the seed beds and spraying the seedlings with colloidal copper or Bordeaux mixture.

Experiments carried out at Gwalior on the wilt disease of coriander indicate that seeds of wilted plant never carry the disease from one season to other and that the fungus remains alive on the surface of the seeds artificially inoculated for five months. Early sowing gives the highest percentage of wilt while late sowing produces practically no wilt. The disease has been provisionally identified as *Fusarium oxysporum*. Further work is in progress.

Two new schemes for investigating the diseases of ginger and chillies in Madras have been sanctioned during the year.

Introduction of milk yielding trees. A few trees which yield milk analogous to the milk of the cow are known to exist in the hot and temperate regions of Venezuela, South America. An incision made into the bark of the tree yields a profuse flow of milk, thick in consistency and exhaling an agreeable flavour. This milk unlike most lactiferous plants, the milk of which solidifies on exposure, retains its fluidity. It does not coagulate on boiling but a layer of creamy consistency, similar to the cream of the cow's milk, is formed on the surface. The total solid contents of the cream are nearly the same as in the cream of the cow's milk.

The nutritive value of the vegetable milk can be gauged from the fact that the natives who use it freely as a substitute for cow's milk, are reported to fatten on it. In addition to its food value, the vegetable milk has been used medicinally for curing asthama.

To a large majority of our undernourished population to whom good, pure cow's milk is rarely or inadequately available, the nutritive milk from the trees, if these can be successfully grown in congenial localities, should prove to be a great boon. Accordingly a scheme for the introduction of milk yielding trees has been sanctioned at a cost of Rs. 3,750 for a period of three years. This scheme will work in the province of Bombay with the object of studying the behaviour, growth requirements, milk yielding capacity and the quality of the milk and to find out the possibilities of introducing the vegetable milk as a substitute for cow's milk.

Fruits

During the year the following five schemes were sanctioned :

(i) Scheme for improvement of soil conditions in spent up orchards in Kumaun Hills, U.P.

(ii) Scheme for research on orange borers in Wynaad, Madras.

(iii) Scheme for investigation and control of orange diseases in Wynaad.

(iv) Scheme for Bud Selection Societies, Bihar. The object of the scheme is, (a) selection of the best trees and (b) multiplication of stocks.

(v) Establishment of Banana Research Stations, Bombay and West Bengal. The objects of the scheme are (a) establishment of a comprehensive varietal collection area for bananas; (b) hybridization and selection of promising mutants; (c) study of propagation practices, packing and transportation methods.

The following schemes came to a close :

(i) *Hill Fruit Research Scheme, U.P.* It was started in 1934 with a view to carry out co-ordinated investigation on

problems concerning orchards, horticultural, chemical, mycological, and entomological topics for scientific development of Fruit Industry in Kumaun Hills. It terminated on 31 March 1949 after running for about 15 years. The results of research achieved are being passed on to the fruit growers. A few of the outstanding results achieved are, (a) the construction of subsoil drainage channels has proved to be the most suitable method for improving water-logged soils in the hills, (b) compost prepared by Maya Dass method has given significantly better yields than that obtained by the application of other methods, e.g. Indore and Bangalore hot fermentation methods.

(ii) *Citrus Problems Scheme, Bihar.* It was sanctioned in 1945 for carrying out a survey on the occurrence of premature dropping, cracking and splitting of fruits with a view to collect relevant information about the varieties affected, incidence of attack and soil and other conditions under which these phenomena appear. It terminated on 31 March 1949 after having run for four years. The two main conclusions reached are, (a) the premature drop of fruits in *Amba-Bahar* is more than that in *Mirg-Bahar* and this is due to the fact that fruits of former set in hot weather and develop in monsoon while those of the latter set in the rains and develop during cool and dry weather of winter, (b) direct relation of fruit drop with rainfall conditions has been established from the fact that the period of maximum intensity of premature fruit drop coincides with the period of maximum precipitation.

(iii) *Orange Marketing Scheme, Coorg.* It was sanctioned in 1942 with the object of introducing regulated system of marketing on co-operative basis, to expand the existing markets, to explore new ones and to introduce 'AGMARK' grading, etc. It terminated on 31 March 1949 after having run for about seven years. Marketing survey has been completed and a Co-operative Marketing Society has been organized to undertake the work included in the programme of this scheme.

At present the following schemes are in progress :

The Bihar Scheme under which research on the problems of fruits, specially to select the best type of mango, *litchi* and papaya are being done, is in progress. A list of the economic varieties of Bihar mangoes has been prepared. As regards *litchi*, 'purbi', 'deshi', 'bedana', 'dehra rose' varieties have been found to grow very successfully in case of papaya, in-breeding has been continued and it has been indicated that

the more purified the strain is, the less is its vigour and that naturally pollinated strains have been found to grow more vigorously than the inbred ones.

The Fruit Research Scheme, Mysore, aims at increasing the longevity of apple plants by the introduction of new stocks immune to collar-rot and woolly aphis. It also includes the study of other important fruits grown in Mysore State, e.g. pineapple, fig, papaya, peach, *litchi*, butter fruit etc. The scheme which was started in 1938 is still in operation.

The Hyderabad scheme was sanctioned in 1941 with the object of determining, from the points of view of both yield and quality, the best varieties of grapes and custard apple. The possibilities of evolving a seedless variety of custard apple by selection and continuous vegetative propagation are under investigation.

The Fruit Research Scheme, Madras, is designed to improve the fruit industry of the plains by undertaking research on the more important commercial fruit crops particularly mango and citrus. Work on classification and nomenclature in case of mangoes has been completed. Additional staff for research on mycological, entomological and physiological aspects has been sanctioned.

The object of the citrus fruit schemes in operation in the C.P. and Berar, Assam, Orissa and Coorg is to find out the best varieties, suitable stocks and quick and easy methods of propogation and suitable cultural methods. The work is in progress. In the case of Assam a monograph on the classification of citrus varieties of Assam has been prepared.

The Mango Necrosis Scheme at Lucknow University aims at finding out the cause of the 'black tip' disease of the mango fruit and at devising control methods for the same. It has been found that the disease similar to natural necrosis could be reproduced by direct injection of extracts of necrotic mangoes and the extracts of healthy mangoes through which brick kiln fumes have been passed. Investigations are being carried out to trace the constituents of the fumes that cause the disease.

The scheme for breeding of improved types of banana at Calcutta University was sanctioned with effect from 1 April 1948 to raise the triploids with 44 chromosomes and some preliminary work on this had been done.

The scheme for cytogenetics of mango and banana, at Poona, aims at cytogenetical study of mangoes and bananas grown in the Bombay Presidency, Central India, the C.P. and the Hyderabad State. The scheme was sanctioned with effect from 1 March 1948 and the work was in progress.

The scheme for a survey of deciduous fruits in Kashmir aims at collecting and recording deciduous fruit varieties grown in the State.

Varieties of apples, plum, cherry and walnut were studied and most of them had been described and identified. The work on the keeping quality of apples and pears is also in progress.

The scheme for controlling insect pests of fruits and fruit trees in the plains of U.P. was sanctioned in 1946. The work on some of the serious insect pests like cecid flies (gall makers), citrus leaf miner, fruit sucking moths and *anar* butter fly is in progress.

The scheme for establishment of a Banana Research Station at Madras was sanctioned with effect from 1 April 1948. Two sub-stations of this scheme have been sanctioned during this year, one in West Bengal and the other in Bombay. The object of the scheme is, (i) establishment of comprehensive varietal collection area, (ii) hybridization and selection of promising mutants, and (iii) study of propagation practices, packing and transportation methods. The scheme has not yet been started.

Scheme for Description of Important Varieties of Fruit Crops Grown in India

The scheme was sanctioned as early as June 1947, but it started functioning only from 8 September 1948, with the appointment of a Botanist. The Assistant Botanist joined on 3 March 1949 and the Artist Photographer's post is still to be filled. The short period during which the scheme was worked, the following items were attented to :

(1) As a preliminary to the work connected with the scheme, considerable amount of data on different kinds and varieties of fruits cultivated in different provinces, the flowering and fruiting seasons of respective fruits and the centres of cultivation of the same were collected.

(2) The important mango growing centres were visited during the flowering seasons during January/March 1949 and detailed morphological descriptions of the tree, leaf and flowers of the 230 varieties of commercial importance were recorded.

Scheme for Collection and Abstraction of Horticultral Literature

The scheme was sanctioned in the year 1946-47 for a period of three years in the first instance for abstraction and collection of horticultural literature.

Shri S. L. Katyal, B.Sc. (Agri.); M.Sc. (Calif.) took charge of the post of Horticultural Abstractor on 1 May 1948. He was assisted by a typist-clerk after about one month of his appointment. Abstracts were taken of the articles published in various Indian and foreign

journals, cyclostyled and issued in leaflet form every month to about 200 horticultural workers in the country. Full use of the libraries at Indian Agricultural Research Institute and Indian Council of Agricultural Research at Pusa was made. The first leaflet was issued in the month of June 1948. The Provincial Horticulturists were requested to circulate the abstracts amongst their technical staff. Some criticism was received from some quarters as to the arrangement of the abstracts and collection of material from Indian journals. In view of this, abstracts are now being taken mostly from the Indian journals and from such foreign papers and articles as might be useful under Indian conditions. The abstracts were arranged under different headings—deciduous fruits, sub-tropical fruits, temperate fruits, diseases and pests, vegetables, floriculture etc.

Scheme for survey of the Soil and Climatic conditions under which Cashew Trees can be grown

The scheme came into operation on 14 October 1948 with the appointment of Shri B. R. Raisinghani as the Ecologist

During the period of last seven months extensive tours were conducted by him in the provinces of Bombay, Madras, Orissa, West Bengal and in the States of Mysore, Cochin and Travancore, in order to study the soil and climatic conditions under which cashew is now growing.

Samples of the different kinds of soils on which cashew is found growing have been collected and are being examined for chemical and mechanical analyses. The climatological data of these tracts has also been collected.

Interesting observations on the habit of root and shoot growth on different kinds of soils have also been recorded. The root system of cashew tree is essentially a tap-root system but it has a tendency to throw out lot of lateral roots on sandy soils; also its shoot growth acquires spreading nature. But on lateritic soils the lateral roots are absent and the shoot does not show as much spreading tendency as on the sandy soils. Although it is too early to draw any definite conclusions, yet, it appears that cashew trees will do well on sandy and lateritic soils in the vicinity of sea.

Vegetables

The Council has been financing the following four schemes on potato research :

(i) *Potato Breeding Scheme in Northern India, Simla.* This Scheme has been running since 1 April 1935. Its main object is to breed high yielding and disease resistant

varieties of potato for the hills and plains. A collection of distinct varieties of *Solanum tuberosum* from India and abroad is maintained and utilized for the breeding work. Some promising hybrids, viz. Nos. 45, 208, 209 and 2236 have been finally selected for multiplication and trial. The work connected with the classification of Indian commercial potatoes has now opened up the possibility of standardizing the commercial stocks used for seed purposes in this country. A number of varieties which are superior to local types in yield, shape and size of tubers and disease resistance have been evolved. Replacement of existing varieties with these hybrids in the areas for which they are suitable will directly contribute towards stepping up the food production in this country. The scheme has been taken over by the Central Potato Research Institute with effect from 1 April 1949.

(ii) *Intermediate Hill Station, Bhowali.* Trials of hybrids for selection are being continued. Hybrid Nos. 29, 16 and 13 secured the first three places with an average yield of 18 :0, 15 :3 and 13 :5 oz. per plant respectively as against 11 :02 oz. for the control. The scheme has been taken over by the Central Potato Research Institute with effect from 1 April 1949.

(iii) *Potato Seed Certification, Indian Agricultural Research Institute.* Work on selection of disease free plants was continued. Multiplication of the disease free nucleus of varieties, Darjelling, Redround and Up-to-date was also undertaken. Examination of the potato crop in selected localities with a view to make observations on the incidence of virus and other diseases was continued as before in U.P., Bihar and East Punjab. As far as possible insect incidence was also recorded in the localities inspected. Attack of both early and late blights was observed at Hapur in U.P. Early blight was observed in an epidemic form and in many fields infection was as high as 100 per cent. Late blight was observed both in Gola, seed of which was obtained from hills and Phulwa varieties. In Phulwa variety, it obviously appeared to be a case of secondary infection. The scheme has been taken over by the Central Potato Research Institute with effect from 1 April 1949.

(iv) *Potato Storage Pests and Diseases, Bihar.* The main object of the scheme is to devise control measures against the potato-moth, *Phthorimoea operaculella* and the fungus diseases of potatoes in storage. The mycological portion of the scheme came to a close on 31 March 1946, but entomological investigations were being con-

tinued. The important results worth mentioning are as follows :

(a) The study of different pre-treatments of the tubers and their reaction on egg-laying capacity of potato moth and subsequent development of the different instars of the pest on the tubers was undertaken. It was found that the moth failed to lay eggs on the treated potatoes and found to die within 24 to 38 hours. Five batches of the moths were introduced during the period of one and a half months and the moths were found dead without laying eggs.

(b) Trials using kerosine oil with water gave the best results in the destruction of the pest in storage.

(c) Sand and onion treatment gave the best results against the incidence of rotting in storage.

(d) It has been found that the greater the irrigation the lesser the percentage of infection under identical soil conditions.

Six schemes on research of tuber crops in Bombay, U.P., East Punjab, Bihar, Orissa and Mysore have been sanctioned during this year. The work is to be carried on on two or three main tuber crops at one centre in each province. Work on tapioca and edible roots has also to be tackled under these schemes.

Soil Science

Investigations on sewage farming being carried out at the Institute of Science, Bangalore have yielded the following results :

(1) Drainage and aeration of the soil are most important in maintaining soil metabolism and production of satisfactory effluents.

(2) The application of burnt lime followed by rest for about a month has been found efficacious in reclaiming sewage sick soils.

(3) Nitrification in the aerated sewage is brought about by a protozoa and not by any bacteria.

(4) Application of sewage during the early stages of plant growth would evoke the maximum crop response irrespective of the type of soil and the nature of crop.

(5) Sandy soil is the best for sewage farming.

(6) Sewage irrigation has a residual effect on the second crop but not to that extent when the soil is treated with lime.

(7) Considered from the hygienic and economic points of view the crops most suited to sewage irrigation are fodder and industrial crops like sugarcane. Studies are now being made with regard to garden crops and fruits.

Further experiments are in progress to arrive at definite conclusions.

Under the scheme for nitrogen fixation in soils at the Indian Agricultural Research Institute, examination of root nodules and isolation of the strains of the nodule organisms of *arhar* and that of gram are being undertaken. At Coimbatore one important observation made with gram was that in the red soil of the Sugarcane Station, nodules were not developed on the crop but in black soil at the college they did develop.

Experiments carried out in the minor and trace elements scheme at the Indian Agricultural Research Institute have shown that plant analysis gives better indication of presence and absence of minor and major elements than the soil analysis. Techniques have been evolved to use, (a) indicator plants for diagnosing soil deficiencies, and, (b) plant infection and spray methods for diagnosis.

The work on crop production by catalysis at the Indian Institute of Science, Bangalore, continued during the year. The results show that the application of ferrous sulphate or magnesium sulphate to the soil after an admixture with organic manure at the rate of 4 lb. to 5 lb. of chemicals per ton of the manure or if applied directly to the soil at the rate of 25 lb. to 50 lb. per acre as a basal dressing, gave increase in the yield of crops. The beneficial effects of ferrous sulphate are mainly due to the action of iron oxide precipitated *in situ* on organic matter. By reacting ferrous sulphate with burnt lime a dry, easily pulvarisable product is obtained cheaply which can be used economically for enhancing crop yields.

Work on the soil erosion scheme at Viswabarathi continued during the year. It was found that the better canopy development of cowpea in the experimental plots arrested erosion more successfully than the grass. Eighteen varieties of American legumes were tried as soil binders. Of these *Lespedeza sericea* has shown the best results so far. The soil binding effects of the *sabai* and the *sewri* grasses are being studied under the run off experiments. The area of the model village garden which was started last year had been increased to two acres. So far erosion has been checked in over 110 acres of land. It is proposed to increase the area to one square mile.

A new scheme for the mineralogical soil analysis of Northern circars has been sanctioned during the year.

Agronomy

The co-ordinated crop weather scheme which is to terminate on 31 March 1949 has been given a further extension. Action was completed during the year for starting the work at the six crop weather stations in the Madras Presidency, viz. training personnel, meteorological installations and lay out of crop experiments. Training of

computers was completed and a number of crop weather observers from Madras, U.P. and Bombay were given three months' course of training. Crop weather calenders, crop-wise and district-wise have been prepared for number of crops with available information and these have been distributed to weather forecasters. A pamphlet entitled '*Weather and Indian Farmer*' has been issued to acquaint the general public and the agriculturist in particular as to what agricultural meteorology can do to help the farmer. It is of interest that this scheme has been adopted by the International Commission of Agricultural Meteorology.

Botany and Cytology

Under the scheme for research on cytology and plant physiology at Almora the following results of vernalization on different crops have been obtained :

1. *Mustard.* All the seven strains of mustard experimented with gave good vernalization response.

2. *Cotton.* Pre-chilling of eight strains of cotton seeds has so far given negative results.

3. *Linseed.* Experiments with linseed have shown excellent vernalization response.

4. *Millets.* No vernalization response was observed in the four strains of millets so far tried.

5. *Rice.* Both pre-chilling of seeds and light treatment of seedlings of ten strains of rice have given negative results.

6. *Soyabean.* Three strains of soyabeans have given very good response.

7. *Wheat.* It has been observed that 46 strains of cultivated Indian wheat gave vernalization responses varying from one to three weeks.

Satisfactory progress was maintained in the Plant Introduction Scheme at the Indian Agricultural Research Institute. Some areas in Orissa were visited and a large collection of useful plant material from the wild vegetation was made. Material was also received from various foreign countries. The indigenous and foreign collections were grown and studied and the new material was also botanically identified. Further addition of about one hundred mounted and labelled specimens of important wild and cultivated plants, indigenous as well as introduced, was made.

Entomology and Mycology

Experiments are in progress at the Indian Agricultural Research Institute, Madras, Bombay and U.P. for testing the efficacy of the insecticides, D.D.T., 666, etc. against agricultural pests. Some treatments in Bombay on mango hopper particularly with D.D.T. 0·2 per cent water suspension spray, D.D.T. (10 per cent) dust with sulphur in the proportion of 1 :1, Gammexane 5 per cent dust with sulphur in the proportion 2 :1 have yielded satisfactory results. Similarly treatment with 5 per cent Gammexane and 7 per cent Gammexane yielded encouraging results on grass hopper (*Hiero glyphus* and *Colemania* spp. respectively). In Madras it was found that incidence of chillie thrips was lower in the benzene hexachloride treated plots compared to tobacco and the yield was increased from 11·8 to 38·7 per cent over the control. Experiments on paddy thrips showed that there was cent per cent mortality in benzene hexachloride, 0 ·25 per cent and 92 ·3 per cent in D.D.T., 0 ·25 per cent tobacco gave 73 ·7 per cent mortality. The experiments at all the centres are still in progress and no conclusions can be drawn at this stage.

The plant virus scheme at Poona continued during the year. It was found that in the Yellow vein-mosaic of *bhendi* a constant temperature of 35°C proved injurious both to the flies and the host plants. The host range of the catgang mosaic virus was further investigated. In the case of sterility disease of *Cajanus cajan* the virus has been successfully transmitted by grafting inside the glass house at Poona. The scheme has been extended till 31 March 1951.

Two new schemes have been sanctioned in the East Punjab, one for the study of the pests in stored cereals and the other for research on the manufacture of synthetic insecticides.

Fruit Preservation Training Course for Ladies

The scheme for training of ladies in fruit preservation and canning continued during the year. The short courses meant for local ladies were closed in November 1948. In all 318 ladies received such training. The advanced course is running and seven girls are being trained. The scheme is due to terminate on 31 August 1949.

Short course. The progress of the Ladies Training Centre has been quite satisfactory. Instead of holding one short course a month two courses a month were given in view of the large number of students coming forward for the same. Even with this arrangement it was not possible to admit all the applicants, some were always left over for the following course so much so that in November 1948, when the Government gave up the scheme, the number of students on the waiting list was 200.

The candidates trained at the Centre from July to November 1948 were as follows :

19th short course	—	(July	1948)	— 47	candidates
20th ,, ,,	—	(July	1948)	— 27	,,
21st ,, ,,	—	(August	1948)	— 21	,,
22nd ,, ,,	—	(August	1948)	— 19	,,
23rd ,, ,,	—	(September	1948)	— 21	,,
24th ,, ,,	—	(September	1948)	— 37	,,
25th ,, ,,	—	(October	1948)	— 20	,,
26th ,, ,,	—	(November	1948)	— 27	,,
		Total		219	,,

Termination of these courses has disappointed the candidates who were on the waiting list, as they came to the Centre to enquire about their admission from time to time.

In addition to these short courses, 112 students from Lady Irwin College also attended the short courses at the Centre specially conducted for them.

We were to start short classes (a series of these short courses) at different refugee centres and clubs etc. but could not do so because of the termination of this scheme.

Total number of candidates trained in short courses since their commencement comes to 1415 only.

Advanced course. The second batch which started in October 1947 terminated in July 1948. There were fifteen candidates (details below) from various provinces who were examined in July and were awarded diplomas :

Bengal	—	2	candidates
Bombay	—	1	,,
C. P.	—	1	,,
Delhi	—	4	,,
East Punjab	—	2	,,
Madras	—	4	,,
Coorg	—	1	,,
	Total	15	,,

The third batch which started from the last week of October 1948 is continuing and is represented as follows :

Delhi	2 candidates
East Punjab	1 (under consideration). The student attending the class since November 1948
Himachal Pradesh	1 candidate
Madras	3 candidates
Total	7 candidates

During their stay at the Centre the advanced course students are given training in the preparation of different fruit products on a semi

commercial and college scale (Products like jam, jellies, preserves, juices, squashes, sauces, ketchup *chutneys*, pickles, vinegar, dehydration and semi hydring spoilage, etc.) Besides this they receive training in the analysis of the various fruit products.

This course was to be completed in the month of July 1949. This year the products prepared by the students were sent to Simla in East Punjab Agricultural Exhibition and also to Jaipur Exhibition for display. At Jaipur demonstrations as to how these products were prepared were also given by a number of students studying at the Centre. The idea was to acquaint the public with the methods of preparation of these products.

CHAPTER III.—FRUIT TECHNOLOGY

General

The Indian Institute of Fruit Technology with its skeleton staff and restricted facilities due to financial difficulties, continued to function under the Indian Council of Agricultural Research during the year under report. Although the decision during the last year was to locate the Institute on a permanent basis under the Ministry of Agriculture in a suitable fruit growing tract in the country, no definite action has so far been taken in this connection.

Biochemical Investigations

Vitamin C concentrates and syrups

Amla (*Phyllanthus emblica*), a rich source of Vitamin C (range 600 mg. to 900 mg. per 100 gm.), has been under investigation for its utilization in the preparation of Vitamin C concentrates and syrups, and fortification of fruit products with Vitamin C. A method has been developed by which the characteristic astringency of the fruit has been successfully removed by treating it in two per cent brine, prior to the preparation of the vitamin concentrate. In a typical experiment, about 65 per cent of the total Vitamin C of the fruit could be recovered in the extract finally prepared. A syrup of 50° Brix prepared from this extract has a Vitamin C content of 146·28 mg. per 100 c.c., is palatable and has been preserved for storage tests.

Experiments on candies and preserves

(a) *Candying of mango slices.* Preliminary experiments have indicated that ripe fruit can be successfully candied in the form of slices.

(b) *Preserves.* At the instance of the All-India Food Preservers' Association, systematic research has been undertaken to standardize methods, firstly, for the preparation of preserves of all kinds and, secondly, for packing and storage of the same. Methods for the preparation of pear, carrot and *amla* preserves have been standardized, while packing and storage trials are in progress.

Preservation of pure citrus juices

Preservation of pure citrus juices, as a source of Vitamin C, has become very popular in countries like the U.S.A. In order to find out the best method for their preservation and storage under local conditions, so that there are minimum changes in Vitamin C, colour and flavour, juices of *Nagpuri sangtra* (*Citrus nobilis* var. *nagpuri*), *mosambi* (*Citrus sinensis* Osbeck var. *mosambi*), sweet lime, (*Citrus aurantifolia* var. *sweet lime*), lime, grape-fruit, *galgal*, (*Citrus limonia* Osbeck) and *khatta* (*Citrus aurantium* var. *khatta*) were packed and

stored under different conditions. The tests carried out so far (upto about eight months' storage) with all these sets have indicated that deaeration of juice prior to packing, and low temperature storage, help in better retention of Vitamin C in the above juices. Out of the methods of preservation tried, 'SO_2' and 'Flash' pasteurization have given the best results, 'overflow' pasteurization being next in order of merit.

Utilization of shariffa, chikoo *and papaya*

Shariffa (Custard apple—*Annona squamosa*), *chikoo* (*Sapota acbrassapota*) and papaya are available in plenty in the country during season. With a view to investigate the possibilities of utilizing these fruits in the preparation of some products, their composition has been determined and experiments have been conducted to evolve recipes for the preparation of squash from each of these fruits as also from *shariffa* pulp blended with orange juice. Preliminary experiments have been conducted on, (i) canning of *shariffa* pulp and *chikoo* segments, (ii) preparation of jam from each fruit; (iii) drying of *chikoo* and papaya and their pulps, and (iv) preparation of *shariffa* cheese. Three months' storage tests have revealed general deterioration in the quality of *shariffa* products; while both *chikoo* squash and canned segments have kept well during two months.

Deterioration in the colours of fruit products during storage

(a) Jaman (Eugenia jambolana) *and tomato juices*. To find the causes of and preventive measures against the deterioration in colour during storage of products from fruits rich in natural pigments, experiments on *jaman* and tomato juices have been undertaken and packs of different treatments are under examination during storage.

(b) *Orange squash and tomato juice*. In preliminary tests carried out with two orange and three red food colours, one orange colour viz. 'Waxoline orange A.S.' (I.C.I.) and two red colours, viz. 'Certicol Scarlet 6 R Crystals' and 'Certicol Coccine' (both from Capcos Ltd., Calcutta) have been found to be suitable for addition to orange squash and tomato juice respectively, to improve their natural colours.

Tamarind beverages

Tamarind has been utilized for the preparation of a cocktail type beverage for which three suitable recipes have been evolved. Preservation and storage tests of this product as also experiments on preparation and preservation of concentrates and sauce, are in progress.

Preservation of cane juice

Pure cane juice has been satisfactorily preserved by chemical preservation (150 p.p.m. SO_2 in combination with pasteurization at 190°F for 25 minutes.

Drying of sangharas, *ginger and mangoes*

(a) Sangharas (*water chestnut*). Experiments on drying of *sangharas* and preparation of flour therefrom have been undertaken to

explore its utilization as a food supplement. A method has been standardized for the purpose. The yield of flour being, however, only 7·0 per cent, it appears that the same cannot be prepared economically, unless *sangharas* are available at a few annas a maund.

(b) *Ginger.* Experiments on drying (curing) of ginger were carried out with a view to preparing an improved quality product but no useful results could be obtained in the absence of the desired quality of fresh ginger.

(c) *Mangoes.* Experiments on drying of ripe mangoes were undertaken to find out if satisfactory quality mango powder could be prepared. Preliminary work has given encouraging results. The problem will be pursued further during the current year.

Clarification of lime juice for cordial making

Though a method for the clarification of lime juice has already been evolved, in a further study about the role of SO_2 (which is usually added to the juice as a preservative) in clarification, it has been found that increasing doses of SO_2 added to the juice help in the clarification process.

Microbiological Investigations

Maintenance of pure cultures

The pure cultures of yeast, bacteria and mould in stock were maintained at the Indian Agricultural Research Institute, New Delhi, for supply to the trade and experimental work.

New cultures of bacteria and yeast, viz. *Lactis delbrukii*, *Lactis casei*, *Lactis pentoaceticum*, *Streptococcus lactis*, acetic bacteria, debaryomyces and ester forming yeast, etc. which were either obtained from outside or isolated in the laboratory, were added to the previous stock of cultures for research work.

Fermentation studies

(a) *Alcoholic fermentation.* Juices from grapes, pears, *jamun*, apples, sugarcane, as well as extracts from dried fruits, were fermented (using different strains of yeast) to give training to the students of Diploma Course Class in the principle and practice of alcoholic fermentation.

(b) *Acetic fermentation.* Vinegar of standard quality is not available in this country. Some experiments were, therefore, conducted to standardize methods of preparation of vinegar from cane juice, *gur*, fruit concentrates as well as alcohol by slow and quick processes. A laboratory generator was designed and its working studied. Encouraging results have been obtained and the efficiency of conversion of alcohol to acetic acid compared favourably with the theoretical yields.

Microbiological studies on brined mango slices

In order to confirm the results of the last year regarding the preservation of mango slices to be utilized in the off season for the manufacture of mango *chutney* and paste, which are important products of our export, fresh mango slices were preserved in brine of 40°, 60° 80° salometer and in powdered salt. Changes in acidity and microflora of the above lots during storage were determined. It was observed that the slices stored in 60° and 80° salometer kept fresh and normal and those in dry salt became meshy and lost all flavour. Samples of *chutney* prepared from the lots stored in 60° and 80° salometer were wholesome and kept well during storage. Work on these lines will be continued.

Preliminary treatments in the making of preserves

A survey of the quality of preserves available in the market showed various types of spoilage, out of which fermentation was the most serious one. This fermentation generally caused by wild yeast, is supposed to occur through contaminated raw fruits.

Experiments conducted to keep the initial high microbial population of the raw materials to the minimum have indicated that washing of fruits with weak solutions of chlorine, acetic acid, sulphite, sodium benzoate and hot water considerably reduced the chance of fermentation in the preserve.

Pickling of amla

Small size variety of *amla* which grows wild can be best utilized for preparation of pickles. A set of preliminary experiments were started to find out a method of keeping the *amla* and its texture in good condition for its subsequent use in making oil and other tyes of pickles. Changes in texture, flavour, astringency, Vitamin C, role of turmeric in pickling and the beneficial effect of acetified brine were studied. Two types of oil pickles, one following a South Indian formula using seasame oil and another of North Indian type using rape seed oil, were prepared after curing *amla* in brine. Storage studies on the above are in progress. Preliminary testing has shown that the product is good both in taste and texture.

Brining of vegetables

To meet the demand of the pickle industry which was handicapped for want of suitable methods to carry over the surplus vegetables available at cheaper rates during the glut season to times of scarcity, experiments were conducted to develop a suitable procedure for the trade. *Ghia* in 40° brine with 0·3 per cent acetic acid had kept well for about nine months but the pickle prepared from it lacked the characteristics of *ghia* so that further experiments had been subsequently planned to improve the quality of the pickles.

Preparation of Indian type of beverage

Spiced carrot juice. Spiced carrot juice (*kanji*) a fermented beverage (lactic acid fermentation) from black carrots is a very popular drink in Northern India. Under usual household methods it cannot keep for long. Out of the eight treatments tried the following, viz. addition of 3·0 per cent salt, 0·3 per cent acetic acid and 0·25 per cent mustard powder to the grated carrots has given encouraging results. Further experiments on its quality and storage are in progress. The method evolved was also given a semicommercial trial.

Study of microflora in pear, amla *and carrot preserves and cane juice*

Microbiological studies in conjunction with the biochemical studies were conducted.

(a) *Pear and carrot preserves.* Various lots of pear preserves from the biochemical laboratory were microbiologically examined to find out the nature and extent of fermentation as well as to devise means of controlling the same.

(b) Amla *preserve.* Microbiological and fermentation tests were carried out in *amla* preserve from the initial to the final stage. It has been noticed that the contamination in this preserve at initial stages was solely due to bacterial infestation and that better storage conditions, high concentrations of syrup, help to check the alcoholic fermentation at later stages.

(c) *Cane juice.* It was observed that cane juice preserved by pasteurization, potassium meta-bi-sulphite and sodium benzoate had fermented after some time. A study of the nature and control of such fermentations is in progress.

Microbiological analysis of fruit and vegetable products

Two hundred and sixty eight samples of various fruit and vegetable products (mostly from Fruit Products Order laboratory), viz. 103 samples of juices, squashes, cordials and syrups, 62 samples of pickles and *chutnies*, 48 samples of preserves, jams, jellies and marmalades, 30 samples of vinegars and 25 samples of canned fruits and vegetables were microbiologically analyzed and reports sent.

Technical Assistance and Advice

Enquiries. During the year under report, 327 technical enquiries dealing with all aspects of Fruit Preservation industry were attended to by correspondence. Sixteen factories were advised in regard to the requirement of capital, layout of plan, machinery, etc.

Personal visits. Five factories in U.P., one in Bombay and one at Calcutta were visited by the Assistant Advisory Officer to render technical and general advice in layout and design of machinery and equipment on spot.

Visitors. A total number of 29 visitors, visited the Institute during the year. These comprised distinguished Government officials, and representatives of the trade who were shown round the laboratories and acquainted with different activities of the Institute.

Exhibitions and publicity. Some members of the staff attended Exhibitions at the All-India Congress Session, Jaipur and Annual fruit show at Simla, where practical demonstrations on home preservation of fruits and vegetables were given besides other general information. Leaflets were freely distributed and charts exhibited to popularize home preservation of fruits and vegetable products.

Library. 22 books, 578 periodicals and 200 bulletins and leaflets were received in the library during the year and correspondence relating to above was attended to.

Teaching

The third course for Diploma in Fruit and Vegetable Preservation (Session 1948-49) was started from 1 May 1948; 17 students were admitted from different provinces, States and Unions. During the year under report 194 lectures in theory each of 1½ hours duration and 146 practicals each of 2½ hours duration including 24 lectures and 10 practicals on microbiology were given to the class. The students were given thorough training in the chemical analyses of fruit products and in the preparation of various kinds of fruit and vegetable products such as juices, squashes, jams, jellies, canned fruit, etc. Besides this, five lectures on refrigeration were arranged at Delhi Polytechnic. House examination was conducted in September 1948 and the students were taken on educational tour to 17 representative fruit preservation and allied factories in East Punjab, Patiala, Nagpur, Bombay and Agra during the month of January 1949.

Experimental work

(i) Experiments to determine blanching times of vegetables were undertaken using peroxidase catalase, enzymic activity as indicator and boiling water, two per cent common salt solution, 0·5 per cent citric acid solution 0·5 per cent sodium bicarbonate solution, etc. as media. This was followed by dehydration and sun drying. Six vegetables were studied altogether.

(ii) Guava squash after storage of six months has been found to retain flavour and taste and a good proportion of Vitamin C also. The Vitamin C contents have been determined to be 48·2 mg. per 100 c.c. as compared with 13·04 mg. per 100 c.c. of orange squash stored under identical conditions.

(iii) Detailed studies involving analyses and physical examinations at different stages of the preparation of *jaman* vinegar had been undertaken with success.

Miscellaneous

(1) The Biochemist attended, (i) the general and the technical Advisory Committee meetings of the All-India Food Preservers Association, (ii) Indian Tariff Board meeting in Bombay for a week to help the Board in protection case of the fruit preservation industry, and (iii) the All-India Horticultural Conference held at Madras.

(2) The Assistant Advisory Officer attended, (i) meeting of the Fruit Product Inspectors convened by the Ministry of Agriculture, (ii) the All-India Horticultural Conference at Madras.

(3) Under the instructions of the Fruit Development Adviser to the Government of India, the Assistant Advisory Officer delivered ten lectures each of two hours duration to the Ladies Advance Course Class and also arranged six practicals.

(4) The Assistant Advisory Officer and the Assistant Professor of Fruit Preservation set one paper each in theory and practical respectively for the Final Examination of the Ladies Advance Course.

(5) The following notes, leaflets, papers and reports were written during the year.

(a) A note for the preparation of mango bread on cottage scale, (b) a leaflet on the preparation of spiced carrot juice and guava cheese, (c) a brief note on the activities of the Institute since its inception, (d) an article on the 'Canning of Oranges' for publication, (e) a paper on the 'Spoilage of Canned Peas' for the Annual Meeting of All-India Food Preservers' Association, published in the *Indian Food Packer*.

(6) About one dozen yeast cultures and mother vinegar were supplied to the trade for commercial fermentation.

CHAPTER IV.—ANIMAL HUSBANDRY RESEARCH

General

The eighth meeting of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry in India met at Mysore from 17 to 22 February 1949. About eighty delegates from all over India attended the plenary session of the Wing which was opened by His Highness the Maharaja of Mysore. Preceding the plenary sessions, the following four committees met simultaneously for two days :

(1) *Ad Hoc* Veterinary Education

(2) Animal Health.

(3) Livestock.

(4) Dairying.

Some of the important recommendations of the Wing are referred to under appropriate headings in this report.

Animal Diseases and Pests

Disease Investigation Scheme for cattle, sheep and goats and poultry were continued in provinces and certain States. And although the provinces of Madras, Bombay, U.P., C.P., Bihar and Orissa have provincialized their Disease Investigation Officers' Schemes since last year, their technical programme continues to be co-ordinated by the Council and the progress report of the work is being considered by its Scientific Committees. In pursuance of its policy to treat India as one unit in the matter of disease investigation, a new scheme for the Disease Investigation Officer was sanctioned for Mysore State, the Council contributing half the share of the expenditure, viz. Rs. 16,500 for a period of three years.

Diseases of cattle and sheep

Rinderpest. Investigation on the incidence of this disease and evolving a still more satisfactory method of immunization with various vaccines were undertaken in U.P., C.P. and Berar, Kashmir, East Punjab and Orissa. In U.P. desiccated and pill vaccines were tried. 28,900 doses of desiccated vaccine were issued for use by sacrification method. Cattle and buffalo were successfully immunized with this vaccine at an altitude of 600 ft. to 900 ft. Goats, however, showed severe reaction resulting in few deaths. Special goat tissue powder vaccine, kept at 37°C for one month and 25 days in refrigerator, was found to be viable when used on ten animals. Reaction was severe in five animals and had to be controlled with serum. It was found that under varying conditions, such as keeping in refrigerator for six days, at 37°C for 40 days, and again for twelve days in refrigerator and five days at 37°C, the desiccated vaccine remained viable. It was also found viable when kept in sun for two hours in addition to above storage. The pill vaccine produced in the United Provinces had also been tried. About sixteen types of it were tested in the field. The best pill obtained so far consists of spleen pulp 1 gm. (or 0.25 gm.

desiccated spleen vaccine) mixed with glucose 0·5 gm., reptone 0·5 gm. and desiccated egg albumen 0·025 gm. all rolled up with syrup glucose or normal saline. These are non-hygroscopic and completely diffuse in 20 to 30 minutes. Viability of these pills at different room temperatures in different months has also been studied. Field tests with different varieties of pill vaccine were conducted with varying results.

In C. P. and Berar 70 cow and buffalo calves were vaccinated by scarification method with variable results since 18 out of 43 animals showed thermal reaction, while 27 had no reaction. The viability of the rinderpest virus was tested under varying field conditions. Virus kept in wooden boxes at room temperature was viable for three days in winter. In wooden boxes with ice and saw dust, it kept potent for four days in summer. In thermos flask with ice it was found to be viable for 7, 10 and 13 days in summer, rainy season and winter respectively. During September and winter it kept viable for seven days under normal transport conditions.

In Kashmir a number of animals vaccinated with goat tissue vaccine developed diarrhoea from 11 to 14 days after vaccination.

In East Punjab mortality in sheep and goats due to rinderpest was 20 to 25 per cent in hilly tracts and 10 to 15 per cent in plains. The disease is reported to be more severe in goats than in sheep. In Orissa experiments were conducted to evolve suitable vaccine for control of rinderpest in sheep and goats. In one group 11 local sheep from plains and hills were inoculated with goat tissue vaccine from Indian Veterinary Research Institute. Out of these three sheep succumbed after 12 and 14 days. Autopsy revealed typical rinderpest lesions. Four sheep vaccinated by S. S. method were found to be immune when tested 30 to 33 days later. Similarly a jersey heifer vaccinated two years previously was found to be immune in U. P.

Foot and Mouth. The scheme for devising a suitable method of vaccination for the control of foot and mouth disease continued at the Indian Veterinary Research Institute and during the year under report seven Indian strains from the field were received and six of these were typed. This has brought the number of strains tested so far to 48, of which 29 are found Vallee 'O' or 'O' variants, 11 Vallee 'A' or 'A' variants, 7 Waldmann 'C' or 'C' variants and one atypical. The atypical strain which was discovered in the Punjab was again typed this year and was found to possess properties more inclined towards Vallee 'A'. From the observations made so far, it is clear that like other countries of the world 'O' type is also predominant in India.

Three brews of crystal violet monovalent blood vaccine and one brew of bivalent (O and A) blood vaccine reinforced with tongue epithelium were prepared. Both these vaccines were found to confer satisfactory immunity on hill bulls. The dosage for hill bulls of monovalent blood vaccine was 50 c.c. while minimum dose for bivalent vaccine was 20 c.c. In another experiment immunity in two animals vaccinated with monovalent vaccine was found to be solid till 19 months after vaccination while with the polyvalent vaccine the immunity was found solid upto 13 months in two bulls and three sheep.

Variable results were obtained when keeping quality of 'Waldmann Gel Vaccine' was tested on bulls after storage in refrigerator (±50°C.) crystal violet vaccine was found to keep potent for over ten days when exposed to atmospheric conditions in postal transit even in the month of June. A sambhar artificially infected with 'C' and 'A' strains showed immunity against 'A' strain when tested 4 and 27 months after vaccination. Porcupines were found to be completely resistant to all the three strains.

In Baroda, incidence of foot and mouth disease is reported to be quite common in goats.

Haemorrhagic Septicaemia. This disease was studied in U. P. only and here 4, 15, 150 doses of composite vaccine were issued during the year under report. In addition to this an outbreak of pasteurellosis in pigs was investigated in which out of 156 large white Yorkshire pigs, 29 pigs of all ages and both sexes were affected and died. Among the affected pigs death supervened within six hours in peracute cases. Experimentally the disease could be transmitted to rabbits, guinea-pigs, crows, goats and buffaloes; but ducks, fowls and country pigs were found resistant.

Anthrax. It was investigated in Madras. Among sheep and goats the outbreaks were found to be hyperacute; affected animals died within few minutes to few hours after the observable symptoms. In the areas where sheep and goats were affected cattle remained free from the disease and vice versa. During this year 4,612 cattle and buffaloes and 10,583 sheep and goats were successfully vaccinated with anthrax spore vaccine. After vaccination immunity in the observed cases was found to range between five to ten months. In the case of 13 sick cattle N. A. B. gave encouraging results.

Tuberculosis. The scheme for the control of tuberculosis and Johne's disease continued to function at the Indian Veterinary Research Institute. Their incidence was studied in Madras, Bombay, U.P., East Punjab, Orissa, Kashmir and was found to be as follows:

Province/State	Number of animals tested	Number positive	Number of suspicious reactors
Ahmedabad (I.V.R.I. Scheme)	(Cattle) 1,552 (Buffaloes) 8,230	137 1,166	67 444
Madras	32	9	—
Bombay	22	—	—
U.P.	34	6+5*	3+1*
East Punjab	1,150†	8	—
Orissa	231	—	4+2*
Kashmir	150	1	4
I. V. R. I.	72	5	—
Assam	634	107‡	—

*Reacted for Johne's disease.

†Tested at Hissar Farm.

‡Reacted either to Johne's disease or T. B.

At the Indian Veterinary Research Institute 25,500 doses of concentrated synthetic medium tuberculin were prepared. Under the same scheme 96 samples of milk collected from different distributing centres in Calcutta and some from Bombay were tested and found negative for tuberculosis. At the Indian Veterinary Research Institute in an experiment 11 Sahiwal calves were injected sub-cutaneously with different doses (50, 10 and 5 mg.) of standard bovine culture. Those inoculated with 50 mg. revealed generalized tuberculosis, while the rest showed only generalized lesion in glands on autopsy. For testing ducks the neck was found to be a convenient site than the web or cloaca.

A separate scheme for survey of incidence of tuberculosis has been started in Bombay Province. At the Livestock Farm, Hissar (East Punjab) it is gratifying to note that the incidence of disease has been reduced from 20 per cent in 1940 to one per cent by regular testing and segregation of the affected cattle.

At the Indian Veterinary Research Institute systematic testing of sheep and goats for Johne's disease revealed that infection occurs widely. 10 per cent goats and 2 per cent sheep gave positive reaction to test while 8 per cent goats and sheep gave doubtful reaction.

Contagious abortion. Incidence of this disease was studied in Madras, Bombay, C.P. and Berar, Assam and Orissa. On quick agglutination tests the following results were recorded :

Province/State	Number of samples tested	Number of positive cases	Number of suspicious cases	Remarks
Madras	(Sera) 138 (Milk) 11 Synovial fluid 6	45 — 1	— — —	
Bombay	137	31	4	Incidence higher in cities
C. P. and Berar	913	170	40	
U. P.	8	—	—	
Assam	33	9	—	

In Madras 280 animals were vaccinated against brucellosis during the year under report. Results of the previous years vaccination were found to be satisfactory since most of the vaccinated animals calved normally.

Surra. This was recorded from Bombay, U.P. and Assam. In Bombay and U.P. 34 and 70 samples were put to Complement Fixation test out of which four and three samples were found positive. In Bombay affected bovines were successfully treated with tarter emetic and two dogs also responded to the same drug. Antrypol was successfully used in Assam on bovines and in Bombay on equines.

Dum Dum or Hump Sore. This disease was investigated in Bihar and Assam. In Bihar seven smears from deep scrapings of the lesions from cattle were examined of which five revealed *Stephanofilaria assamensis.* Besides hump the lesions were also noticed on the legs and other parts of the body. Tarter emetic injection and local application of its 1 per cent ointment were found effective. In Assam, investigation into the etiology of hump and ear sores showed the presence or association of a large number of ensheathed nematode larvae and also adult nematode worms of *Stephanofilaria* sp. in the skin lesions. Application of 1 in 25 tarter emetic ointment for two weeks was found good as a curative particularly if the treatment is completed before monsoon.

Investigations on the Effect of Oestrogens. In West Bengal observations on the use of synthetic Oestrogens for inducing lactation on cows were made. 20 non-lactating cows of different ages including multiparous sterile cows, aborted heifer and cows and nulliparous heifers were given intramuscular injections of 'Stilboestrol dipropionate' (Veterinary) varying from 70 to 310 mg. spread over a period of 1 to 5 weeks. All these animals except cows responded well to the treatment and had milk yield comparable to normal lactation. One of the heifers which received 300 mg. Stilboestrol started giving milk one pound daily in 6 days, over 5 lb. in 16 days, over 10 lb. in 34 days and over 15 lb. in 99 days reaching the maximum daily yield of 16 lb. in 105 days counting from the first day of injection. During the experiment all the animals remained healthy and some actually gained in weight.

Anaerobes. At the Indian Veterinary Research Institute various techniques for the isolation of *Clostridium chauveoi* were tried. The scheme has been further extended upto 31 March 1950.

Clinical Nutrition Survey

Clinical Nutrition Survey (Deficiency Diseases). A clinical survey and investigation on the incidence of conditions caused by nutritional deficiencies were made in various provinces. In Assam iodine deficiency was the main problem encountered. Two calves suffering from this disease were successfully treated with iodine salts. Climatic and soil conditions are reported to be mainly responsible for the prevalence of this disease. In C. P. and Berar a number of cases were suspected for flourosis. The affected animals showed debility, lameness, deformed hoofs, exostosis of ribs, mottled incisors and pica. Phosphorous deficiency was also seen in 2 to 15 days old lambs. In Bihar Avitaminosis 'A' was also observed in cows.

Sheep Pox. In Madras it is reported to occur once in every three or four years. Mortality in the outbreaks that were investigated ranged between 12 per cent to 43 per cent. In Madras and Bombay non-infected sheep were vaccinated by scab vaccine without any good effects. Adult sheep were found to be rarely affected in Bombay.

In Mysore some improvements were made in the manufacture of sheep-pox vaccine. The pox-virus preserved in glycerine was found to remain potent for over seven months but in dried state deterioration commenced from second week. In East Punjab serum sensetized and glycerinated pox vaccines were tried. With the former, both thermal and local reactions were observed on the 4th and the 5th day after vaccination. In the case of glycerinated vaccine the reaction was in the form of a pustule formation at the site of inoculation on the 4th or 5th day.

Entero-toxaemia. The disease is reported to be enzootic in Baroda and causes about 95 per cent mortality. It is observed to have a seasonal occurrence, outbreak occurring a fortnight after the onset of monsoon. Both sheep and goats were found to be susceptible but cattle remained unaffected 99 per cent among the affected were adult animals and lambs under 6 months were rarely affected. In collaboration with the Indian Veterinary Research Institute the disease was found to be caused by *Clostridium welchii.* It is contemplated to prepare a toxoid from the culture collected from affected material and to try it as prophylactic.

Encephalomyelitis in goats. This affection was observed in goats in Orissa but its aetiology could not be established definitely, although the histopathological examination of cerebro-spinal system indicated it as encephalomyelitis.

Poultry diseases

A further survey of the common contagious disease of poultry has been carried out this year by all the Assistant Disease Investigation Officers (Poultry) in the various provinces and States. Almost all the common poultry diseases were encountered during this survey.

Ranikhet Disease. The disease was responsible for the highest mortality in poultry in all the provinces. In East Punjab, survey revealed that due to routine vaccination Ranikhet disease has been stamped out completely from the Government poultry farms and that the incidence is at a decline in other districts where vaccination is practised. In Bombay the disease occurred all over the province and was prevalent throughout the year but was more common in hot summer months. Both acute and sub-acute forms of the disease were observed and the mortality was about 90 per cent. In U. P. on the contrary outbreaks were more common and severe during winter, and birds of all ages and breeds were equally susceptible though *desi* fowls were comparatively resistant. In C. P. and Berar four outbreaks were investigated but no special regional breed or seasonal incidence had been noted. In all the provinces and States vaccination of birds was undertaken with satisfactory results. In Bombay and Bengal it was observed that there was no breakdown of immunity in birds that were vaccinated in the previous year. In C. P. it was observed that in actual outbreaks instead of segregation and disinfection alone, wholesale vaccination using a fresh needle for each inoculation should be carried out, and that even in an infected lot vaccination can be

done with some advantage. Chicks below two weeks were not found to contract the disease naturally. The vaccination reaction in chicks below four weeks was found to be mild. In C.P. the only post-vaccination reaction noted was cessation of egg laying for 3 to 4 weeks subsequent to vaccination. In Bombay 2 to 3 per cent of the vaccinated birds showed paralysis of one or both legs; 25 per cent to 35 per cent birds had reduction in egg laying capacity lasting for 2 to 3 weeks. In one instance the reduction was 60 per cent and did not return to normal till 3 to 4 months, while in another case R.I.R. layed almost white coloured eggs for 3 to 4 weeks. In U. P. chicks below 12 weeks were found to react more severely than adults and the mortality among them ranged between 3·2 per cent to 6·5 per cent. Birds infested with worms usually die after vaccination. Vaccination was found unsafe in actual outbreaks. Reaction and mortality are more severe in hot weather. Vaccination under ideal conditions was found to stimulate egg production and improve laying. In some cases even the non-layers were found to come in lay after vaccination. In Hyderabad the vaccinated birds showed a high degree of resistance in the face of an outbreak. The mortality in incontact birds was 95 per cent after vaccination.

Fowl-cholera. Outbreaks were reported from West Bengal, Madras, and U. P. In West Bengal an outbreak among *saras* (*Antigonea antigonea*) was effectively controlled by simultaneous inoculation of serum and vaccine. In Madras outbreak of chronic fowl-cholera was recorded. Here *Pasteurella avicida* was isolated in pure culture. The latter was found non-pathogenic for fowls but pathogenic for rabbits, pigeons and ducks. Sero-vaccination successfully controlled the disease.

Fowl-pox. It has been recorded in most of the provinces and States and existence of its various forms has been observed. In Madras more commonly cutaneous form occurred in adult birds and roup form among chickens; the latter affected one or both the eyes. Mortality among chicks with helminthic complications was rather high. In U.P. heavy losses due to the disease occurred in youngstock in hatching season. Here also cutaneous form has been more common in adults with 2 to 3 per cent mortality while ocular and mouth forms have been common in chicks and resulted in 90 per cent mortality. Diptheritic form was common in Bihar. Vaccination has been reported to confer satisfactory immunity in West Bengal, Baroda, U.P., C.P. and Berar, Madras and Hyderabad. In Madras, however, in an infected area the disease flared up after vaccination with pigeon-pox vaccine. In Bombay turkey chicks vaccinated at the age of 8 weeks contracted the disease in mild form when four months old. In Mysore 3,300 chicks were successfully vaccinated with pigeon-pox vaccine. This vaccine was also effective on adult birds in actual outbreaks.

Spirochaetosis. This has been reported from Bombay, West Bengal, U.P., East Punjab, C.P. and Berar, Baroda and Hyderabad. In Bombay and East Punjab outbreaks were common during summer months,

while in C.P. and Berar outbreaks were more common in winter months. All the breeds are reported to be equally susceptible in U.P. but in East Punjab heavy breeds are said to be more susceptible. Mortality was high among chicks. In C.P. *desi* breeds in general were found to be more resistant while among R.I.R. and W.L.H., the former was found to be more susceptible. Immunization of birds with Sulfarsenol and virulent blood has been successfully practised. Soamin, Stovarsol and Sulfarsenol were successfully used in controlling the outbreak. Gammaxane D.O. 25(T) and L.G. 140 gave promising results in dusting tick infested birds and spraying tick infested houses respectively.

Tuberculosis. Routine testing of birds against tuberculosis was continued in many provinces and States. In Bombay 427 fowls and 67 ducks over one year old were put to tuberculin test—only one duck gave doubtful reaction. Here one positive case was observed during routine post-mortem examination also. Two positive cases were detected on post-mortem on a farm in West Bengal. Thereafter in these farms out of 65 birds tested four were positive and 5 doubtful reactors. At a Government poultry centre all the 487 birds tested gave negative reaction. In Madras out of 31 birds tested with single intradermal method, one gave suspicious reaction. Liver of two other birds was found studded with tubercular nodules, and smears from them revealed *Mycobacterium tuberculosis*. In U.P. out of 235 birds tested none gave a positive reaction. In C.P. and Berar out of 217 unthrifty adult ducks and 147 fowls subjected to tuberculin test, only one duck was found positive while 19 ducks and one fowl gave a doubtful reaction.

Coccidiosis. This was detected in almost all the provinces and States. In Madras heavy mortality was recorded. In U.P. youngstock was found to be more affected and mortality in them was about 80 per cent to 90 per cent. In C.P. and Hyderabad examination of faecal samples revealed, *Eimeria tenella*. Various drugs were used and Sulphamezathine gave very good results as a curative. Similarly Sulphaguanidine, Sulphathizole, and Stovarsol were found to be effective.

Helminthiasis. In almost all the provinces and States common species of poultry worms such as *ascaridia*, *heterkis*, and *railleitina*, were recorded. In Bombay out of 183 faecal samples 41 were positive for nematode and 7 for cestode worms. In U.P. the incidence was found to be very high but it was found that due to worms comparatively there was less loss of condition in *desi* fowls than in the improved breeds. Iodine vermifuge was found effective. In C.P. and Berar out of 761 faecal samples 65 (8·54 per cent) were found positive for tapeworms. On post-mortem 8·60 per cent birds showed this infestation. As therapeutic agents cestrasol, carbon tetrachloride, phenothiazine, root extract of pomegranate tree and colloidal iodine were found effective though comparatively cestrasol gave better results. In Baroda cestrasol was found to be effective for *Capillaria* infection.

In Hyderabad, contrary to observations made elsewhere treatment with phenothiazine, carbon tetrachloride, oil of chenopodium and male fern did not give satisfactory results.

Infectious catarrh. In Bombay treatment of affected birds with Potassium iodide in drinking water for 8 to 10 days gave satisfactory results. In Mysore this disease appeared to be most serious in chicks kept under farm conditions. Insanitary conditions and inclement weather are said to increase the mortality.

The scheme for the study of poultry and cattle lice functioning at Aligarh University terminated this year and eight species of poultry lice were identified and redescribed after the study of their morphology. Nine species of sucking and biting lice of cows, oxen and buffaloes and sheep and goats were collected and classified. Biology and the habits of some of these were studied. In addition to this a complete study of the external morphology and internal anatomy of the buffalo louse *Haematopinus tuberculatus* Burmeister was made.

Helminthiasis. The scheme for the investigation of helminthic infestation of livestock continued to work at the Indian Veterinary Research Institute and in the University of Lucknow and Madras and West Bengal Veterinary Colleges. In Madras studies on the life history of *Ascaris vitulorum* are being continued.

A study of the bionomics of mite connected with life cycle of *Monezia* was made and it was found possible to obtain 9, 27 and 34 days old cysteccrccids from an experimentally infected mite. It was concluded that onchospores take about 5 weeks to develop into infective cystecercoids.

In Lucknow University bionomics of the mite of *Erythracus* sp. which is connected with life history of *Monezia* was studied. These mites were artificially fed on cestode eggs and were found to contain different stages of embryo when dissected on different days. Similar experiments on mites were done with eggs of *Avitellina centripunctata* and *Stilesia globipunctata* but no developing embryos were recovered from any of the mites.

A further extension of two years was sanctioned for the Madras and Lucknow helminthiasis schemes.

At the Indian Veterinary Research Institute the study of histopathological changes produced by *Dicrocealum dendriticum* in liver were undertaken. No change in the parenchyma or stroma of the infected liver was observed except for the mild catarrh of bile duct lining. Observations did not show the parasite on the surface of the liver, thus indicating that the parasite migrated into the liver through the bile duct. For controlling amphistomiasis (*Gastrothylax crumenifer*) infestation in ruminants as prophylactic 1 per cent copper sulphate was found to be effective. In Kashmir dosing of animals with rhizome of crude male fern was found effective against distomiasis and parasites were found to disappear in three weeks.

In Bombay a parasitic survey of sheep and goats was carried out by examination of faecal samples and post-mortem examinations when several varieties were encountered. *Coenuris cerebralis* cyst was found in thyroid gland of a nine mouth old male goat. In another animal *Trichuris ovis* infestation having 2,500 to 3,000 worms was the cause of death by occulsion of intestine and resulting toxaemia. Incidence of *H. contortus* and *O. columbianum* was found to be 51·9 per cent and 48·09 per cent respectively. Both these parasites were also observed in East Punjab and Baroda and Phenothiazine was found effective in all the places.

Indigenous Drugs

The scheme for the investigation of indigenous drugs was continued in Madras and six drugs with reference to their toxic, chemical and pharmacological effects were studied. From the root of *Acorus calamus* a volatile oil was extracted and its antiseptic and germicidal effects were studied. The toxic effects produced by *Lochuera pusilla* were found to be caused by its local effect on gastro-intestinal tract and not due to the alkoloid present in it. The scheme has been recommended to be taken over by the Indian Veterinary Research Institute.

Animal Nutrition

Vanaspati. Experiments were continued at the Indian Veterinary Research Institute to determine the comparative nutritive value of the various edible oils, lard, Dalda and cow *ghee*. Growth rate of animals fed on oils varied depending upon the type of the oil and its condition i.e., raw or refined. Experiments are being carried with fourth generation to confirm the results. In the second generation clinical symptoms such as xerothalmia, cataract and paralysis were observed in some groups, but these disappeared on liberal feeding. Observations on the animals of third generation are still incomplete.

The results of reproduction and lactation studied over two generations do not point to any significant difference between the different oils amongst themselves or in comparison to *ghee* on the one side and Dalda on the other. Observation on the animals of the third generation are in progress.

Calcium and phosphorus absorption is also much less with edible oils as compared to cow *ghee*.

Fodder. In Assam a set of experiments were started to find out the effect of acid and alkali producing diets such as *ulu* and paddy straw on calcium, phosphorus and nitrogen balance. There was increased dry matter and protein digestibility with *ulu* feeding as compared to paddy straw. Nitrogen and phosphorus balance was positive in both cases. Addition of calcium salts such as calcium carbonate and calcium chloride to the diet did not materially effect the calcium balance regardless of whether the diet was acidic or alkaline.

Digestibility experiments carried out on *dal*-hay show that it compares favourably with other Indian feeding stuffs of similar nutritive value as regards its digestible protein and starch equivalents. Experiments on feeding of early cut *dal*-hay show that a positive nitrogen, calcium and phosphorus balance is obtained. The supplementation of calcium chloride on the basal ration of hay showed an increased retention of calcium in some cases.

Indigenous grasses. Animals fed with *anjana* (*Cenchrus citiaris*) *baib* (*Eulaliposis binota*) and *sarwala* (*Hetropogon contortus*) grasses at Indian Veterinary Research Institute maintained normal health and nitrogen, calcium and phosphorus balances were positive. The average amount of hay consumed (on dry basis) per 100 lb. of liveweight was 781·8 gm., 785 gm. and 576·6 gm. respectively in case of above mentioned grasses. The digestible crude protein values of the three grass hays were superior to those of spear grass hay and *juar kadbi*, while total digestible nutrients and starch equivalent figures for *baib* and *sarwala* were markedly superior to *anjana*, spear *juar* and mixed hays.

Observations on nutritive value of *bargad* (*Ficus bengalensis*) and *pipal* (*Ficus religiosa*) leaves were made. Animals fed on *bargad* leaves alone showed considerable loss in liveweight, the balance of nitrogen was highly negative in all animals and phosphorus in 50 per cent, while the retention of calcium was satisfactory. *Pipal* leaves on the other hand seemed to constitute a satisfactory maintenance ration, as all the animals gained in weight and had positive balances for nitrogen, calcium and phosphorus.

Experiments on the extensive use of alkali treated straws for feeding cattle, horses and mules were continued at four centres—Sodepur, Puri, Rampur and Montgomery (now in Pakistan). In the two rice straw centres, at Sodepur and Puri, the alkali treated straw-fed young calves were found to be growing at the accelerated rate of 67 per cent. and 74 per cent than control animals fed on untreated straw. In the two wheat straw centres, at Rampur and Montgomery, the alkali treated straw-fed young calves were found to be growing at 192 per cent and 17 per cent accelerated rate over their respective controls fed on untreated straw. Detailed statistical analysis of the data is being done.

The scheme on feeding of standard ration to *ryote* cattle sanctioned at Orissa continued to function during the year. A new scheme for better utilization of pastures and straw has also been sanctioned at Madras.

Breeding

Cattle breeding. A review of the cattle improvement schemes financed by the Council was made during this year and it was realized that these schemes had failed to give the desired results on account of certain economic considerations. It was, however, considered that schemes on similar lines should be introduced in selected areas where

producers were organized on co-operative basis, and that 'key' village schemes which would improve the cattle in breeding tracts and other rural areas should be initiated in all provinces and States as early as possible. Except the cattle improvement scheme at Chhata in U.P. and the Kankrej scheme at Ahmedabad, all the other schemes financed by the Council have been closed. The Ahmedabad scheme has been provincialized. The Council has sanctioned the inclusion of the Amrit Mahal breed in the scheme to investigate the possibility of using milking cows for work and to see if there is any deterioration in the milking capacity.

About 500 new entries were registered in the Central Herd Books for Sahiwal, Red Sindhi, Kankrej, Hariana and Gir breeds of cattle and Murrah buffaloes. No animals were registered in North West part of India during the year under report. A proposal is under consideration to extend the activities connected with recording and registration to the Amrit Mahal and Hallikar breeds of cattle.

Sheep breeding. The sheep breeding schemes financed by the Council made a fairly steady progress during the year under report. A suggestion has been made to research workers at Madras that the possibility of selecting the foundation flock with superior wool may be looked into. The Madras sheep breeding scheme has shown that the quality and quantity of wool produced by the Bellary sheep can definitely be improved by feeding the sheep on good pasture. At the Bombay Wool Analysis Laboratory, a fine sample of wool from Bellary sheep was encountered during the course of analysis of samples received from Madras. As a result of a suggestion made by the Council to the Government of Madras, they are establishing a sheep breeding unit with the fine wooled sheep found in the Nilgiries.

The Bombay sheep breeding has been extended to further test the acclimatization of the Merino sheep to the Deccan climate and the Merino stock has been removed to Belgaum which has a more equable climate and good pasture.

Due to disturbed conditions in Kashmir work on sheep has been slow under the scheme and much of the foundation stock was taken away by the raiders during 1947-48.

The Bikaneri sheep breeding scheme in East Punjab has shown that breeding, for improvement in quality and increase in quantity of wool, has an adverse effect on the size of sheep and should be taken into account, when judging the progress made.

The Wool Analysis Laboratories attached to sheep breeding schemes are lending support in the selection of sheep for breeding purposes.

The Bombay University Wool Analysis Laboratory has observed that wool produced from castrated males is in no way superior to that from uncastrated ones.

Rajputana is famous for its fine wool producing sheep and a scheme has been sanctioned by the Council for making a preliminary survey of the various types of sheep found in that part of the country.

The Council has recently appointed a Special Officer for procuring commercial samples of wool from various trade centres for fixing standards for Indian wool.

Due to the partition of India on 15 August 1947, the position of the wool industry called for special attention. A greater proportion of fine and medium type wools used in Indian mills and exported were produced in N.W. India, and as that part of the country had been included in Pakistan, an endeavour was being made by the Council to survey the position and to make India self-sufficient in the matter of wool supplies by an intensive programme of selective breeding of indigenous sheep and cross breeding of indigenous sheep with Merinos.

Goat breeding. The Punjab Indigenous Goat Breeding Scheme which aimed at building up a pure flock of Betal breed of goats of superior milk strain by suitable breeding methods had been making a progress for the past nine years, but unfortunately during 1947-48 the season was bad and owing to heavy rains considerable mortality was caused through encephalomyelitis and all the bucks in use in the different groups died and had to be replaced. Mortality in adult goats and kids was also high. These losses have caused severe set back to the scheme but as a sufficient number of progeny of goats in different groups is available it has been possible to continue the work.

The progress in case of Orissa Goat Breeding Scheme, which has been sanctioned with a view to evolve two superior breeds of goats—one for South and the other for North Orissa—by grading up with imported milch goats from the Punjab (Betal) and by selective breeding of black Bengal respectively, has been very slow due to heavy incidence of disease and the unsuitability of the farm in which they were originally housed. It is now proposed to provide better browzing facilities to remove the farm from Angul to Russulkunda where grazing and browzing areas are much better than what are available at Angul.

A scheme for the improvement of milk yield of goats in Malabar by selective breeding has also been sanctioned in Cochin.

The Angora Goat Breeding scheme at Hissar continued to work. Four Angora bucks have been imported from U.S.A. for evolving a Punjab type of Angora goat by developing Mohair, producing characters in Himalayan type of indigenous goat under local conditions.

Poultry breeding. The Poultry Developmental Research Scheme, C.P. progressed satisfactorily and some important results were achieved regarding production capacity and size of eggs of *desi* hens of the successive generations and their grades under well-managed farm and ordinary village conditions. A number of improved cocks of D.L. and R.I.R. were given in the developmental villages. Some loss was however, experienced due to avitaminosis and wild animals.

Under the scheme of Poultry Village Extention, Indian Veterinary Research Institute, it was proved that environments had a great influence on the egg production of fowls. Careful management, good feeding and improved housing give the highest average yield, good feeding and housing came next and good feeding with ordinary houses and good housing and ordinary feeding give very poor yields in comparison to the first two, while primitive conditions gave the lowest yields.

Dairying

To transport milk over long distances, trials have been carried out at the Indian Dairy Research Institute, Bangalore, for preservation of milk over long periods required for transporting milks, with following results :

(1) The keeping quality of milk processed by different time/temperature combinations is effected by, (a) the age of the raw milk prior to processing and, (b) the temperature of storage of processed milk. With raw milk, age not exceeding three hours both the treatments, namely, 145°F/30 minutes and 170°F/10 minutes are equally effective. When, however, the age exceeds three hours the latter time/temperature combination gives better results.

(2) The maximum proliferation of micro-organism takes place, (a) after eight hours of storage with initial processing time/temperature combinations of 145°F/30 minutes and 150°F/15 minutes, and, (b) after ten hours of storage with processing time/temperature combination of 17°F/0 minutes and 170°F/10 minutes. At the end of these storage periods, if milk is reprocessed at 170°F/0 or ten minutes the storage life can be extended to about 40 hours at atmospheric storage of 75° ± 3°F. When the storage temperature increases to 80°F and 98·6°F, the life is reduced to about 24 and 20 hours respectively.

(3) Intermittent processing does not materially affect the chemical composition and marketable quality of milk. Such milk on spontaneous curdling, however, is found difficult to churn for butter making and *ghee* made therefrom is not only poor in yield but also of unpleasant smell and flavour.

The composition of milk of Indian cows, buffaloes, goats and sheep has been investigated at Indian Dairy Research Institute, Bangalore.

Among the different breeds of cows studied, Red Sindhi seems to give the richest milk, richest in fat, total solids, solids-not-fat, ash and protein. All the other indigenous breeds are more or less comparable

in the richness of their milk. Cross-bred cows give slightly poorer milk, poorer mainly in fat content. Buffalo milk is found to be much richer than the milk of any of the breeds of cows including Sindhi, particularly in fat, total solids, solids-not-fat, lactose, Vitamin C, proteins, calcium and phosphorus. Goat's milk is more comparable to cow's milk except for slightly higher protein, Vitamin C and mineral contents. Sheep milk is by far the richest of all the milks studied—richer mainly in total solids, solids-not-fat, ash, Vitamin C, protein, calcium and phosphorus.

There was no significant difference in the composition of the *ghee* samples collected from different breeds of cows. Buffalo *ghee* was characterised by higher Reichert, Krischer and Saponification values and lower iodine and Polenske values. Goat's *ghee* gave the lowest Reichert and Krischer values and highest Polenske and iodine values. Except for the higher Reichert and Krischer values sheep *ghee* was more comparable to goat *ghee*.

A scheme for the development of *ghee* industry has been successfully run in C.P., Jhallar.

The scheme has achieved a useful purpose in developing a co-operative organization in a backward area which helped to produce more *ghee* of a better quality and obtain better prices by eliminating the middle man.

A scheme for surveying the types of *dahi* produced and marketed in different parts of the country, covering the three seasons of the year, has been completed. A total number of nearly 1,000 samples of *dahi* (including *lassi*), secured from dairies, *halwais*, street vendors and private houses were collected from selected urban and rural areas. They were examined for their physical properties, acidity, nature of microflora as revealed by microscopic appearance and total bacterial count at the centre of collection and for their fat, protein and ash contents at Bangalore. The samples of *dahi* were also plated on appropriate media for the isolation and identification of lactic acid bacteria. The best samples proved to be those obtained from Calcutta, Allahabad, Brindaban and Tinkut valley while those obtained from South India were usually sour and in a watery condition. The difference is attributed to better quality of milk used in North India and more organized methods of production.

Standard of conditions for producing high quality *dahi* have been investigated and the starter likely to give the best result manufactured. A scheme for desiccation of starter so as to extend its use over vaster area has been recommended.

The samples from West India showed either a preponderance of *Streptococci*, a balanced proportion of *Streptococci*, and lacto bacilli in all seasons, while those from South India showed a preponderance of lacto bacilli. During summer and monsoon there was greater number

of samples which were sour and were associated with peptaization, gas formation and fermentation.

It has been found that genuine *ghee* does not contain more than ·2 per cent linoleic acid.

The scheme for the quality improvement in milk and milk products and their costing continued during the year at the Agricultural Institute, Allahabad, and their various aspects, such as cost of improving the quality of milk and milk products, the extent to which it can be achieved both efficiently and economically, construction and design of dairy equipment and cost of controlling more common deterioration in milk were studied.

Under the scheme 'Survey of bacteriological quality of market milk in India', during the period under review, some 1,000 samples of milk obtained from various sources in Bangalore were studied and analyzed with regard to bacteriological quality of market milk. In the case of organized dairy farm the average bacterial count varied from below 10,000 per ml. at the time of production to about 5,00,000 at the time of delivery during the winter. During the summer the bacterial count increased from below 25,000 per ml. at the time of production to about 262,000 for cow's milk and 12,50,000 for buffalo's milk at the time of delivery. In the summer the methylene blue reduction times varied from 390 to 180 minutes for cow's milk and from 376 to 113 for buffalo's milk. The corresponding methylene blue reduction times decreased from 466 to 191 minutes. And from 423 to 180 minutes for cow's and buffalo's milk respectively during winter. Milk delivered in bottles always showed a lower count than that handled in cans.

A very large number of samples of milk were examined at the Indian Dairy Research Institute with a view to find the variation in the freezing point of milk from indigenous breeds of milch animals and test its applicability to detect adulteration of milk. Nearly 97 per cent of the milk of the hard samples, gave freezing point below 0·530° C, average being 0.548°C for cow's and 0.549°C for buffalo's milk. By the freezing point test, addition of 3 per cent of water can be detected assuming the average freezing point of milk to be 0·538°C. The activity covered the freezing point pasteurization and season had no effect and there was no difference in the freezing point of whole and separated milk. The freezing point of goat and sheep milks was found to be lower than that for the cow and buffalo milks.

Bee-Keeping

All-India Bee-Keeping Research Station, Lyallpur, was shifted to Katrain, (Kulu), East Punjab. The work on classification of *Apis indica* F. bees into varieties and strains was interrupted on account of partition, but efforts were to be made to collect the material and continue the work. A comprehensive plan of selective breeding has been initiated to improve the stock and increase the average production per colony. Steps are being taken to import *Apis mellifica* from U.S.A.

for crossbreeding work. Artificial insemination of queen bees is also to be studied as soon as the necessary apparatus is available. In the biometry experiments, it was noted that the tongue length of a worker honey bee has a direct bearing on its capability and capacity for nectar collection. The tongue length of *Apis indica* F. came to 5 :185 m.m. as compared to 6 :438 m.m. of *Apis mellifica*.

The Entomology Committee of the Council reviewed the work on the development and recommended the setting up of some more research stations.

Fish

Under the Madras Rural Piscicultural Scheme studies have been made on the food, growth and breeding of *Barbus carnaticus* Jerdon *Cirrhina* sp. and *Thynnichthys Sandkhol day* and on the bionomics of some of the fishes landed during previous years. Hydrobiological investigation in the Chetput Farm waters and other impounded waters in the province has been carried out in addition to the study of problems of transport and acclimatization of live fish and acquatic manuring and fish productively.

Under the Fish, Eggs and Larvae Scheme at the Madras University, studies of the various states of development of species of certain fish were made.

A detailed study of the commercial species of penaeid prawns, viz. *Penaeus carinatus*, *P. indicus*, *Metapenaeus* was also made at the Madras University. It was found that these species feed upon both animal and vegetable matter. The stomach contents are of green and brown microscopic algae, organic debris as well as minute copedods, The occurrence of these prawns in all the back water areas indicates their capacity to withstand low salinity but as no penaeid prawn has been found to breed in the back waters it is inferred that they go back to the sea for breeding. This is supported by the presence of early larvae in the marine plankton. It is probable that their breeding does not take place in summer months.

This year the Indian Council of Agricultural Research has awarded one scholarship for studying of pests of stored fish at the Travancore University.

Hides and Skins

During the year under report dressing operation for the control of warble-fly was continued and near Dehra Dun three affected areas and a control area were selected for dressing, singeing and combined dressing singeing methods. A survey of these areas revealed that the warble-fly infestation in these areas was 37.0, 39.2, 46.0 and 39.0 per cent respectively. Since the *Hypoderma lineatum* is known to have a seasonal occurrence, four dressings with derris or tobacco and lime were applied from October to January.

To study the geographical distributions of *Hyalomma aegyptium* and *Haemophysalis bispinosa*, ticks were collected in adults, nymphal and larval stages from U.P., C.P. and South India. As a result, it was found that *H. aegyptium* is by far the more common tick infesting cattle in North India, while *H. bispinosa* is more common in South India. The incidence of the ticks on the whole is heavier in South India. The length of the mouth parts of *H. aegyptium*, particularly the hypostone, appears to be responsible for the excessive damage to the horium of the hide.

For the study of bionomics of these ticks, they were fed artificially on cattle and it was observed that after the female tick is fully matured she detaches herself and lies in a secluded place and remains quite for 5 to 10 days depending upon the atmospheric temperature. She is to lay eggs. Protracted exposure to sunlight destroys fertility of eggs and this point is considered useful when erecting tick proof cattle sheds.

Rhipicephalus haemophysaloides was found to occur commonly in cattle in South India and rarely in U.P. and C.P.

During the year a method was evolved for preparing microtomic sections of pieces of damaged hides and a few sections were made to study the histopathological changes caused by adult ticks *H. aegyptium* and *Boophilus australia* in cattle hides.

As reported last year hand dressing of the tick affected animals was found to be more suitable than dipping under Indian conditions. Arsenical dips used in U.K. and U.S.A. were found unsuitable for India because of the lack of co-operative system amongst stock owners, poisonous nature of the drug and danger of chemical and bacteriological changes caused by sun heat on exposed dips. Hand dressing of cattle with Gammexane [D. 025] resulted in 75 per cent. to 95 per cent. mortality of ticks after 24 hours of application. Drug had a residual effect upto 5 to 9 days depending whether the animal is stall fed or not. Hand dressing with Hexyclan powder indicated that it is in no way inferior to Gammexane. At the Indian Veterinary Research Institute a dip consisting of Sulphur 2 per cent, potassium or sodium hydroxide 1 per cent, sulphonated castor oil 1 per cent, linseed or mustard oil 1 per cent and water 95 per cent was found to be effective for the control of mange mites. The effect was found to last till about three months This solution did not damage the skin of kids and goats. As a curative for mange Gammexane [D. 025] gave encouraging results. In another experiment it was found that the larvae of *Dermestes vulpinus* does more damage on the flesh side of the hides and that they prefer to feed on under surface of the folded hides and skins and that the damage was more on the edges than in the centre. Dermestes vulpinus was successfully bred under laboratory conditions and it was found that 20 to 22°C is the most suitable temperature for their prolific propagation. The breeding technique has been described in detail, 2·5 per cent Gammexane [D. 919] was found satisfactory to control this beetle infestation. One per cent. Gammexane [D. 025] was found to be equally good. Napthaline dust though provided some protection permitted the larvae and adults to feed upon the treated skin.

CHAPTER V.—DELHI DEVELOPMENT SCHEME

General

A scheme was prepared by the Vice-Chairman in consultation with the Deputy Commissioner, Delhi, with a view to trying out the development of a compact group of villages in the Delhi province by the practical application of the results of research. The scheme provided for improving two compact blocks, one in an irrigated area and the other in an unirrigated area in Delhi. The *modus operandi* of the scheme was to take ten villages in each block as they were and to improve them through the agency of the villagers themselves in the following manner :

(1) By encouraging mixed farming.

(2) By increasing the area under, and yield of food crops by sowing improved seeds, using improved implements, making better use of farmyard manure and artificial fertilizers, wherever practicable.

(3) By conserving cowdung for manurial purposes by plantation of suitable trees for fuel and providing silage pits and sullage from the Delhi Municipality.

(4) By improving the existing breeds of cattle (a) by castrating scrub animals (b) by making greater use of improved sires.

(5) By encouraging cottage industries like poultry and pigs which are managed mostly by the poorer and lower castes.

(6) By improving the social and cultural life of the villages and creating an interest among the villagers in development schemes by organizing village *panchayats* and building *panchayatghars* in each village.

The Council itself would provide skeleton staff in each village or a group of villages for rendering free technical advice. Arrangements would be made for the supply of improved seeds, improved implements etc. at concession rates. It was proposed to have a *panchayatghar* in each of these villages.

The scheme was approved by the Advisory Board in 1947 and sanctioned by the Governing Body in January 1948. The total estimated

cost for five years is Rs. 8 lacs. A Rural Development Officer was appointed with the necessary technical and subordinate staff and work was initiated from 1 April 1948. The scheme has been started only in the irrigated area in the first instance comprising the ten villages mentioned below :

1. Badli
2. Shamepur
3. Sahibabad
4. Pehladpur
5. Barwala
6. Puth Khurd
7. Sultanpur Diwas
8. Bawana
9. Daryapur Kalan
10. Auchandi

The question of extending it to the unirrigated area has been left over for the present till experience is gained of its working in the irrigated area. Special Committee, consisting of the Vice-Chairman, Indian Council of Agricultural Research, the expert advisers of the Indian Council of Agricultural Research and certain advisers of the Ministry of Agriculture, the Deputy Commissioner, Delhi and certain specialist officers of the local Administration, was also simultaneously constituted to plan and direct the work under the scheme and to ensure that the targets fixed under the various subjects were attained. With a view to associate the villagers directly with the working of the scheme, a small village Committee consisting of three of their own elected representatives has been formed in each of the ten villages. The *mukkaddam* stationed in each village works directly under the village Committee. The Presidents of these Committees, ten in all, form a Central Committee of which the Rural Development Officer is the Secretary.

Activities

The following is a brief statement of the activities so far undertaken in this scheme :

Agriculture. Arrangements have been made for obtaining improved agricultural implements of various types and sets of different types of improved implements were tried and five hundred of Shabash Ploughs that were liked by the cultivators have been obtained from Naini Agricultural Institute, Allahabad.

Arrangements were made to distribute improved seeds of the following crops during the year :

Kharif	*Jowar*	430	Md.
	Cotton	1	Md.
	Maize	20	Md.
	Guar	480	Md.
	Sugarcane	270	Sets
Rabi	Wheat	700	Md.
	Gram	2,000	Md.
	Potato	60	Md.
Horticulture	Fruit seedlings	2,400	

Side by side with this, facilities were also provided with the help of the Plant Protection Adviser to the Government of India, for the treatment of the seed with insecticides.

As a large dump of town refuse was available near these villages in Badli and there was great demand for this manure by the cultivators, about 600 truck loads of this manure was distributed to cultivators.

Animal Husbandry. The intention was to carry out wholesale vaccination of cattle in all the ten villages as a prophylactic against rinderpest but as the Control of Cattle Disease Act recently passed by the East Punjab Government had not so far been extended to the Delhi Province, this was not possible. Consequently vaccination was carried out on the scene of outbreaks and the disease controlled. In regard to poultry, all country cockrels have been replaced by leghorn and Rhode Island Reds. Certain villages have purchased these hens also. The staff employed on the animal husbandry side has also rendered technical advice in cases of occurrence of diseases such as foot and mouth disease etc. All the ten villages have been supplied with approved cow and buffalo bulls and other male stock is being castrated.

A scheme for the collection and transport of milk to Delhi for disposal from one village for the present, is under consideration.

Fisheries. Arrangements have been made for trying the possibility of introducing pisciculture in seven of the ten villages where the scheme is in progress. Five tanks have been selected for the purpose covering in all ten acres and operations have already been started with the advice of the Assistant Fisheries Development Adviser to the Government of India. Three of the tanks have already been stocked with fingerlings.

It is premature to say anything regarding the prospects of the scheme because the general activities which are multifarious in nature, have been started only within the last few months and it is too early to expect any results of importance. The officers of the Council and the other expert advisers often visit the villages to see the progress of the activities from time to time and give technical advice. The villagers are appreciating the help rendered to them and are readily agreeing to take up improved methods advocated by the Department.

CHAPTER VI.—COMBINED AGRICULTURAL AND ANIMAL HUSBANDRY RESEARCH SCHEMES

Village Rehabilitation Scheme, Baroda

This scheme was undertaken to study the influence on economic, social and other aspects of village life by comparing the various land tenures such as tenancy at will, land belonging to a proprietor, personal proprietorship and co-operative and collective farming on holdings, all of equal sizes. The results indicate that this scheme has proved beneficial to the villagers and that the proprietary system gives the best income. This scheme is still in progress.

Soil Science

A scheme for the trial of different kinds of trees, shrubs, and grasses in the semi-desert tract of Shekhawati (Jaipur State) with the object of preventing soil erosion by wind and to get suitable varieties of these plants to increase fodder supply has been sanctioned at a cost of Rs. 23,400 spread over a period of three years.

Kudzu vine is assuming an increasing degree of importance in the soil conservation programme as a soil binder and as affording an excellent fodder to the livestock. Its propagation on an extensive scale has been much handicapped because of its lack of seed setting ability. The Council has sanctioned a scheme with a view to determine the environmental conditions that influence seed setting in the important vine as well as to compare the performance of different species of *Pueraria* occurring in India and which are recorded to set seed regularly.

This scheme has been sanctioned at a cost of Rs. 20,190 spread over a period of three years and is to be worked at the Indian Agricultural Research Institute.

Fodder and Grasses

A scheme with the object of finding out the methods of making silage most acceptable to the cultivators, to observe the effect of silage on the health of cattle and milk production and to attempt to popularize silage making has been sanctioned at a cost of Rs. 36,690. This scheme will work in Patiala State.

CHAPTER VII.— STATISTICAL BRANCH

General

Dr P. V. Sukhatme, Statistical Adviser, Indian Council of Agricultural Research attended the meeting of the Standing Advisory Committee on Statistics of the Food and Agricultural Organization of the United Nations held in Washington in September 1948 as Vice-Chairman of the Committee.

Advisory Work

The Branch continued its advisory work relating to the design of agricultural and animal husbandry experiments and the interpretation of their results, examination of technical programmes and annual reports of the Council's scheme and the scrutiny of statistical papers received for publication in the Council's journals. A number of statistical enquiries received from the Food and Agricultural Organization of the United Nations, Central Government, Provincial Governments, Central Commodity Committees and other institutions were also dealt with.

Training

Twelve students were admitted to the Certificate Course and six to the Diploma Course in Agricultural Statistics during the year 1948-49. The Short Training Course was also started during the year under report and eighteen students were deputed by the Central, Provincial and State Governments, etc.

Six students were successful in the Certificate Course Examination and two in the Diploma Course Theory Examination held in September 1948. The thesis submitted by Mr P. N. Saxena was examined and approved and he was declared to have successfully completed the research work for the Diploma.

Eighteen students of the Short Training Course were examined on the completion of 1st term of the course in December 1948 and all of them were declared successful.

The students of Certificate Course were taken to the Indian Agricultural Research Institute to study the problems in practical agriculture in the various Divisions of the Institute. They were also taken on an instructional tour during March 1949 to the Agricultural Farm, Karnal and the Livestock Farm, Hissar. The students of the Diploma Course paid a visit during March 1949 to the Institute of Plant Industry, Indore, where they studied the problems in Genetics and field experimentation.

At the instance of the F.A.O., the Indian Council of Agricultural Research have agreed to establish a training centre under the Statistical Adviser for training officers entrusted with the work of the World Agricultural Census, 1950.

Research

The crop cutting surveys were continued during the year under report on wheat in the provinces of the U.P., Bihar, the C.P. and Berar, the East Punjab, Ajmer-Merwara and Delhi, on paddy in Madras, the U.P., Bihar, C.P. and Berar, Assam, Orissa and Coorg, on *jowar* in C.P. and Berar and on gram and *masur* in Bihar. With a view to extend these surveys to other principal crops and to set up suitable

statistical organizations in various provinces on a permanent basis to take up the survey and other work relating to the improvement of agricultural statistics, the Statistical Adviser, Indian Council of Agricultural Research, and the Economic and Statistical Adviser, Ministry of Agriculture jointly prepared in consultation with the Provincial Governments a five year co-ordinated scheme for conducting crop cutting surveys on the principal crops in various provinces. The scheme has been submitted to the Government of India for sanction and is still under their consideration.

The survey on Aerial Photography could not be continued during the year under report as the results of using colour photography instead of colour filters for identification of crops on the prints were not made available by Messrs Air Survey of India. It is, however, proposed to continue the work during the year 1949-50.

The Statistical Adviser has prepared two pilot schemes on the possibility of adoption of random sampling technique, (1) for estimating the total catch of marine fish at Malabar Coast, Madras, and (2) for estimating the number of cattle of various descriptions. The schemes have been sanctioned by the Governing Body of the Council and will be implemented during 1949-50.

Short notes were prepared on the following subjects for use of the Ministry of Agriculture and the F.A.O. of the United Nations :

(1) Note on sample surveys from estimating crop yields.
(2) Note on the methods of compiling area and yield statistics of crops in India and the improvements brought about in the latter by random sampling surveys.
(3) Note on the possibility of estimating by sampling the total quantity of cattle yard manure used on fields in a given area.
(4) Note for assessing the results of the Grow More Food Campaign.

At the instance of the Indian Oilseeds Committee a scheme for the improvement of yield statistics of oilseeds was also prepared.

The following research work was published by the staff of the Statistical Branch, Indian Council of Agricultural Research during 1948-49 :

1. On a method of estimating mineral requirements in metabolism studies by samples by P. V. Sukhatme, S. S. Prabhu and V. N. Amble—*Journal of the Indian Society of Agricultural Statistics*, Vol. I, Part II, 1948.
2. A statistical study in the composition of milk by P. V. Sukhatme, V. G. Pendharkar and A. N. Sankaran —*Miscellaneous Bulletin* No. 61 (I.C.A.R.)
3. The first and the second Factorial Moments of lome probability distributions arising from points on a lattice by P. V. Krishna Iyer—*Biometrika*, Vol. 36, Part I.
4. A new approach to Sampling distributions of the multivariate normal theory by R. D. Narain—*Journal of the Indian Society of Agricultural Statistics*, Vol. I, Part II, 1948.

5. On the completely unbiased character of tests of independence in Multivariate Normal Systems by R. D. Narain—*Current Science*, February 1949.

6. Distribution of the sum of roots of a determinantal equation under a condition by D. N. Nanda—*Annals of Mathematical Statistics*, Vol. 20, 1949.

In addition three reports have been published embodying the results of crop-cutting experiments in the provinces.

CHAPTER VIII.—AGRICULTURAL MARKETING

General

Dr T. G. Shirname Ph.D., F.S.S., continued to hold charge of the office of the Agricultural Marketing Adviser to the Government of India. Mr S. C. Chakravarty was appointed to officiate as Marketing Officer (Livestock), and Mr V. P. Anantanarayanan was appointed to officiate as Supervising Officer Grading Stations *vice* Mr K. P. Jain appointed as Marketing Officer. A number of changes also took place in the cadre of Assistant Marketing Officers.

On account of the abnormal conditions consequent on the partition of India, there was a general slackness both in the survey and report-writing work as well as in the development work. This was noticeable particularly in the provinces of East Punjab and West Bengal. The Agricultural Marketing Adviser and the Deputy Agricultural Marketing Adviser, therefore, visited most of the provinces and States and impressed on the authorities concerned the need for strengthening and reorganizing marketing organizations and for undertaking developmental activities.

The Agricultural Produce (Grading and Marking) Act not being applicable to the Indian States, a number of difficulties presented themselves in the administration of the various grading schemes in the Indian States and the reputation of 'Agmark' was threatened. It was, therefore, considered essential to have an executive agreement between the Government of India and the States Governments to enable the Agricultural Marketing Adviser to take suitable and prompt action in the areas concerned in matters connected with 'Agmark' grading. The draft agreement was finalized and steps were being taken for its execution with the Union Governments and individual States. However, it is hoped that the legislative position in the States will correspond before long to what is now prevailing in the provinces of India, and there will be no need to proceed with this measure.

Surveys and Reports

Survey reports in respect of a large number of commodities have gone out of stock. As there is a keen demand for most of these reports, revised editions of the more important among them *e.g.* groundnuts, rice, milk, fish, hides and cattle were being prepared. The fish, castor seed and milk reports, and the Fish Guide were revised for the Indian Union and sent to the press. During the year, all-India marketing survey reports in respect of *ghee* and other milk products, and cardamoms and a Supplement to the Wheat Report were also issued. Reports on rapeseed and mustard, stone and small fruits, sann hemp, and arecanuts were finalized and sent to the press. Reports on maize and millets, mangoes, sesamum and nigerseed, fibres, meat and poultry were under preparation. The work of translating the abridged editions of the all-India survey reports, which had been suspended in 1947, was resumed. Translations in Hindi

of the abridged reports on milk, co-operative marketing, potatoes, rice, groundnuts and bananas having been completed are being scrutinized. At the instance of the Ministry of Food, special surveys on the stocks of gram and its products and pulses and into the causes for the continuous and steep rise in the prices of important foodgrains were conducted. Small and handy brochures summarizing the principal features of marketing were issued in respect of milk, fish, wool and *isubgol*. Similar brochures for groundnuts, sugar, arecanuts, hides, skins and futures associations were also under preparation.

Development Work

Grading and Standardization

The progress in this direction was satisfactory. Produce worth about Rs. 12 crores was graded during the calendar year 1948 as against Rs. 10½ crores in 1947.

Livestock and Livestock Products

Ghee. The decline in the volume of *ghee* graded, noticed in 1946, continued during the present year, although the number of authorized packers increased. This was chiefly due to the measures adopted by the Directorate to ensure that only *ghee* of known purity is packed under the 'Agmark'. Restrictions imposed by provincial governments were also stated to be coming in the way of grading larger quantities. Inspite of these facts, *ghee* grading stations were established in the Madras province where no *ghee* had been graded so far. Grading was revised in Baroda, and a revised scheme was introduced in the Central Provinces and Berar; suitable measures were taken for controlling the quality of graded *ghee* by stiffening the grade standards, provision of additional quality tests, etc. The P.A. test was also introduced in certain laboratories during the year under review. During the year, a building for the subsidiary laboratory in Kathiawar was made available at Rajkot by the Saurashtra Government. The laboratory is expected to start functioning shortly. With a view to making the scheme self-supporting, the *ghee* label charges were raised to 10 annas per maund with effect from January 1949.

Butter. The grading of butter gained more popularity during the year and two new packers joined the scheme. The design and size of the 'Agmark' butter label were revised.

Eggs. There was no improvement in the grading of eggs except that an Egg Grading Demonstrator was appointed during the year and egg grading was revived in Delhi after a lapse of two years.

Hides. No hide grading station functioned during the year under review.

Edible Oils

The grading of mustard oil was confined mainly to the United Provinces. It is proposed to start shortly grading of mustard oil in West Bengal and gingelly and refined groundnut oil in

the Bombay province. Grading of gingelly oil has also been started in the Madras province. In order to ensure supply of pure vegetable oils, the Indian Oilseeds Committee recommended that arrangements should be made for compulsory grading of vegetable oils under the 'Agmark'. The matter was under the consideration of the Government. Meanwhile, steps were being taken to prescribe specifications for important vegetable oils under the 'Agmark'.

Fruits and Vegetables

The grading of fruits was affected substantially by the partition of the Punjab. The number of authorized fruit packers dropped to 97 in 1948 from 118 in 1947. Grading of apples in the East Punjab and of other fruits in the Bombay and Central Provinces was, however, continued. Citrus Fruits Grading and Marking Rules embodying all provisional specifications so far prepared were issued in supersession of the Orange Grading and Marking Rules. The grading of potatoes was revived in the Madras province.

Special Crops

Sann Hemp. The amended Sann Hemp Grading and Marking Rules were enforced from 1 September 1948. No private marks which indicate a trade description or grade different from that indicated by the corresponding 'Agmark' label can since be applied on graded bales. In all, 83,628 bales were graded during 1948 as against 93,140 during the preceding year. This decline was mostly due to the transport difficulties and to the fall in prices.

Tobacco. The tobacco grading scheme showed a steady progress. The number of authorised packers rose from 267 in 1947 to 293 in 1948 and that of grading centres from 40 in 1947 to 53 in 1948. 57 million lb. of tobacco valued at about Rs. 5 crores were graded during the calendar year, 1948. As a recognition of its importance, usefulness and success the scheme was extended for a period of five years with effect from 1 April 1948.

Grading of cotton and of sugarcane *gur* on a small scale was continued. There has been no grading of *bura.*

Export Trade

It is a well known fact that the reputation of Indian agricultural produce and, consequently, the price realized by it in the international markets are very low. This indicates the necessity of instituting standardized grading of agricultural exports. The commodities, important in the export trade are lac, wool, goat hair, hides and skins, curry powder and ginger, walnuts, cashewnuts and vegetable oils (including castor oil). A scheme to control the quality of lac was drawn up. In 1948 wool was included in the schedule to the Agricultural Produce (Grading and Marking) Act and prominent exporters

of wool were approached for voluntary grading of the commodity before export. The question of grading it on a compulsory basis was under the consideration of the Government. Goat hair was also included in the schedule to this Act and tentative grade specifications fixed therefor. Grade specification for curry-powder, ginger and turmeric will be drawn up as soon as their survey which is in hand, is completed. Grade specifications for castor oil, as approved at a trade conference held in August 1949, were notified for adoption under the Agricultural Produce (Grading and Marking) Act. Preparation of grade specifications for coconut oil and a standard contract for trading in milling copra was also taken up.

Regulation of Markets

Legislation already exists in the provinces of Bombay, C.P. and Berar, Madras, East Punjab, Mysore, Hyderabad, Baroda, Gwalior and Patiala for regulating agricultural markets. Some of them have also made considerable progress in the establishment of such markets. Bombay prepared a five-year plan to regulate more than half of the markets in the province. Active efforts were also being made in other provinces and States in this direction.

Weights and Measures

The Bihar Weights Act, 1947 was brought into effect on 1 December 1948. There was no further progress in the other provinces and States.

Licensed Warehouses

The provinces of Bombay and Central Provinces and the Travancore State passed acts for the establishment of licensed warehouses. Other provinces are being persuaded to enact suitable legislation on the subject to fulfil the wide-spread and insistent demand for warehousing facilities in this country.

Futures Trading

A draft Order for regulation of produce exchanges was circulated to the provinces. Pending the enactment of the new Constitution under which 'Stock Exchanges and Futures Markets' is a subject for Union regulation, it is proposed to issue the Order under the Essential Supplies (Temporary Powers) Act, 1946. The Order incidentally provides for the adoption of standard contracts for trading in futures markets.

Inspection of Foodgrains

The Ministry of Food were advised on various matters connected with the importation of foodgrains from foreign countries. Inspection of imported foodgrains was carried out at ports. Proposal for a new scheme of inspection entirely by an official agency to replace the present zonal scheme was under examination. Various complaints in respect of the quality of foodgrains supplied under the Basic Plan were

examined. Ration shops and issue depots in the Delhi rationed area were inspected, and matters requiring attention brought to the notice of the Director of Civil Supplies, Delhi. An Inspection Training Course was conducted at Nagpur. The Director of Inspection was deputed to the French Indo-China to negotiate a rice deal with that country and to arrange the shipping of the quantity. He also attended the Inter-Dominion Conference at Karachi in May 1948, as an Adviser.

Conferences, Meetings, etc.

During 1948, a castor oil conference was held at Bombay for considering the draft specifications for castor oil. The Hon'ble Minister for Food and Agriculture inaugurated the 6th *Ghee* Conference at New Delhi on 20 September 1948. The conference reviewed the working of the 'Agmark' *ghee* grading scheme and considered ways and means of expanding and strengthening the activities under the scheme. The 10th Marketing Officers' Conference was held on 18 and 19 October 1948. It was inaugurated by the Secretary, Ministry of Agriculture, and addressed by the Hon'ble Minister on the second day. The conference adopted a number of resolutions regarding marketing, surveys, development work and the organization of the Central and provincial marketing staff. The meetings of the different commodity committees of the Indian Council of Agricultural Research, its Advisory Board, and those of the Indian Oilseeds Committee, Indian Standards Institution, Indian Central Tobacco Committee were attended by the Agricultural Marketing Adviser and other officers of the Directorate from time to time. A number of references on agricultural marketing from Government offices and public were attended to and advice tendered.

CHAPTER IX.—GENERAL

Publication

Indian Farming. On account of the continued delay in the printing of *Indian Farming*, there was a steep fall in the number of paid subscribers to the journal, so much so that the number came down to 592 after the release of the April 1948 issue from 1827 registered after the printing of the April 1947 issue. The circulation figures, however, showed an increase towards the close of 1948. The number of paid subscribers for the December 1948 issue of *Indian Farming* was 818. This was due mainly to the liquidation of a part of arrears in printing. On 31 March 1949 the journal was in arrears by the following issues :

(1) December 1947,
(2) January 1948,
(3) February 1949,
(4) March 1949.

With the printing of the December 1947 and January 1948 issues, the work of printing the arrear issues by the Indian Press, Allahabad, will be over and the Job Press, Kanpur, alone will have to print the journal.

Scientific Journals. The pace of printing of the scientific journals was considerably accelerated and the arrears were reduced to a great extent. Whereas in March 1948, as many as 8 and 4 issues of the Indian Journal of Agricultural Science and the Indian Journal of Veterinary Science and Animal Husbandry respectively were in arrears, in March 1949 the journals were in arrears by the following issues only :

Indian Journal of Agricultural Science—March 1948, June 1948, September 1948, December 1948, March 1949.

Indian Journal of Veterinary Science and Animal Husbandry—December 1948, March 1949.

Arrangements were made for the preparation of blocks and printing of plates through the Government of India Press, Calcutta, which printed the two scientific journals, as it was found out that the previous arrangement under which blocks were prepared at Kanpur and sent to Government of India Press, Calcutta, for reproduction was cumbrous and unsatisfactory. This has resulted in speeding up the printing of the journals.

Kheti. The publication of *Kheti*, the Hindi counterpart of *Indian Farming* commenced from May 1948 but the journal had a bad start in as much as the first issue appeared in July 1948. In March 1949 the journal was in arrears by the following issues : January 1949, February 1949, March 1949.

To ensure timely publication the Controller of Printing and Stationery has withdrawn the printing work of *Kheti* from Hindustan Times Press and entrusted to Delhi Printing Works, Delhi.

Miscellaneous Bulletins. The following bulletins were published during the year :

(1) *Miscellaneous Bulletin* No. 60 'Preparation of Compost Manure from Town Wastes' by C. N. Acharya (3rd Edition),

(2) *Miscellaneous Bulletin* No. 61 'Composition of Milk' by Warner, Sukhatme and others.

(3) *Miscellaneous Bulletin* No. 66 'Memorandum on Fibres other than Cotton and Jute' by J. K. Sarkar.

In consonance with the decision of the Advisory Board of the Council to publish a quarterly journal entitled '*The Bulletin of the I.C.A.R.*' in place of the *ad hoc* miscellaneous bulletins, the Government of India has been requested to accord sanction to the publication of the above-mentioned journal. The decision of the Government of India is awaited.

Occasional publications. A pamphlet entitled *Trend of Cattle Population in India*' by H. K. Lall, Assistant Animal Husbandry Commissioner with the Government of India, was published. This pamphlet describes the variations and changes in the cattle population of various Indian provinces and States and aims to assess the factors which have governed the changes in the population and to determine their exact importance.

The Second edition of the '*Memorandum on the Development of Agriculture and Animal Husbandry in India*' was published.

Publications Committee. (i) The Publications Committee considered the general question for granting subsidies to various bodies for bringing out publications and decided that the question be referred to the Advisory Board for laying down a definite policy to be followed in such cases. The Committee recommended that pending the decision of the Advisory Board the contribution to such bodies should be 33 per cent of the cost of printing up to a maximum of Rs. 2,000 subject to certain conditions. The Advisory Board accepted the recommendations of the Publications Committee and agreed that the Council should grant subsidies to the scientific societies for the printing of their journals on a uniform basis of one-third of the cost of printing up to a maximum of Rs. 2,000 per annum in each case. It was also agreed that the necessity for continuing the subsidy should be reviewed from year to year on the basis of a report on the utilization of the grant by the societies and a statement of their accounts.

(ii) As recommended by Publications Committee and approved by Advisory Board, the Deputy Principal Information Officer in the Ministry of Agriculture was appointed as a member of the Publications Committee.

(iii) The Committee continued to receive valuable assistance from a large number of specialist referees in the examination of papers received for publication.

General. In pursuance of the decision of the Government of India to cut down expenditure and effect economies in the administration, the scheme for the taking over by the Council of the work of printing and distribution of the journals was postponed till 1950-51. The scheme for the establishment of an Information Bureau under the aegis of the Council was also postponed for the same reasons.

The Library

In pursuance of its objects to aid agricultural research, the Council maintains an up-to-date research and reference library for the use of its officers and persons actively engaged in research work in agriculture and cognate sciences in the provinces and States of the Indian Union. The library has a valuable collection of about 70,000 volumes on agriculture, animal husbandry and allied subjects, made up of books 10 per cent, pamphlets 40 per cent, and periodicals 50 per cent. It receives about 600 scientific and technical journals of which 150 are subscribed and the rest are received through exchange relations which the Council has with scientific institutions and societies all over the world. Besides these journals, the library receives a large number of technical pamphlets, bulletins, circulars and leaflets by virtue of exchange with foreign agricultural and veterinary research institutes and experiment stations.

The main library is housed in the library building of the Indian Agricultural Research Institute, Pusa, New Delhi, and the working section of the library is attached to the office of the Council at 'P' Block on the Raisina Road for the immediate use of the Council's officers. It would greatly add to the usefulness of the library if the two sections into which the library is split up at present for want of accommodation, could be centralized and located near the office.

Library Statistics. The total number of books and publications in the library on 31 March 1949 was 70,139 as against 66,687 last year. 3,452 new books and publications were added during the current financial year as against 2,215 last year.

The loan of books and circulation of periodicals reached a total of 18,922 against 17,855 last year. This figure does not include a large number of books and periodicals consulted in the library by the officers, students and research workers. A particularly heavy demand was recorded for books on statistics required by the students of the Training Courses in statistics. Some of the books were in such a large demand that they had to be declared as 'Books not to be issued out' so that they could be freely consulted by all in the Library Reading Room.

Classification and Cataloguing. All new additions of books and publications are accessioned, classified and catalogued. An up-to-date card catalogue indicating the author, subject and other analytic information arranged on a dictionary basis, is maintained. A classified

shelf card catalogue based on decimal classification is also duly maintained. Besides these, a printed catalogue together with typed lists of monthly additions to the library is available to date for consultation in a handy form.

Reference and Information Service. The Council's library maintains an information and bibliographical service on topics relating to agriculture and animal husbandry for the aid of the research workers all over the country. Important articles on specific topics relating to agriculture, veterinary and allied sciences are indexed and abstracted from about 400 scientific and technical journals. Horticultural literature abstracted by the Horticultural Abstractor of the Council is also indexed. The indexed cards form an important source of latest information available for reference. It may be mentioned that the library supplied to officers and research workers references on a large number of topics, some of which are mentioned below :

> Wool characteristics of Corriedale sheep; Entero-toxemia in sheep and goats; Jute substitutes; Industrial fibres; Bibliography on fodder and milk production; Cultivation of medicinal plants in India; Plantation of tung oil tree.

A press-cuttings service has been recently introduced in the library. Cuttings of important articles on agriculture, animal husbandry and dairy in India and of writings relating to the activities of the Council, are taken from important newspapers and circulated to officers.

APPENDIX

Annual account of Income and Expenditure of the Indian Council of Agricultural Research for the year 1948-49.

RECEIPTS				PAYMENTS				
Head of Accounts	Receipts during the year	Grants Original	Grants Net	Head of Accounts	Expenditure during the year	Excess (—) or Savings (+) over net grant	Remarks
		Rs.	Rs.				
I. Opening Balance	11,31,211 5 7	..	..	A—STANDING CHARGES			
II. General Receipts		25,000	19,000	1. Accounts & Audit	18,780 11 0	+219 5 0 (*a*)	(*a*) Inconsiderable.
1. Receipts under the Agricultural produce Cess Act.	17,16,650 0 0	9,000	3,600	2. Travelling allowance of non-official members of the Council.	3,534 4 0	+65 12 0 (*a*)	
Deduct—amount transferred to Reserve Fund.	(—)5,00,000 0 0	24,000	26,500	3. Travelling allowance of members of the Committees of the Advisory Board and of other persons invited to attend the meetings.	26,632 15 6	(—)132 15 6 (*a*)	
	12,16,650 0 0						
2. Grants from the Indian States.							
(*i*) Mysore	5,000 0 0	1,000	700	4. Travelling allowance of non-official members of the Board of Agriculture and A.H. in India.	696 12 0	+3 4 0 (*a*)	
(*ii*) Baroda	5,000 0 0						
(*iii*) Kashmir	10,000 0 0						
(*iv*) Travancore	5,000 0 0						
(*v*) Cochin	10,000 0 0						
(*vi*) Bikaner	10,000 0 0	3,000	5,300	5. Miscellaneous	5,280 9 0	+19 7 0 (*a*)	
(*vii*) Bhopal	2,500 0 0						
(*viii*) Jaipur	20,000 0 0						
				B.—RESEARCH, TRAINING AND PUBLICITY UNDER DIRECT CONTROL OF I.C.A.R.			
3. *Interest from investments*				(*i*) *Agriculture*			
(*i*) 2½% loan 1948-52	5,486 4 0						
(*ii*) 3½% loan 1947-50	..	1,00,000	1,10,000	1. Indian Institute of Fruit Technology.	95,078 8 3	+14,921 7 9 (*b*)	(*b*) Saving due to non-receipt of debit for stores and several posts remaining unfilled.
(*iii*) 3% loan 1963-65	49,361 4 0			2. Do. (Development)			
(*iv*) 3% 2nd Victory loan 1959-61.	14,962 8 0			3. Do. (Wines Research)			
(*v*) 3% Victory loan 1957.	55,546 12 0						
(*vi*) Fixed deposit etc.	15,043 8 0	..	30,000	4. Ladies training in Fruit Preservation.	28,637 5 0	+1,362 1 0 (*c*)	(*c*) Saving due to non-payment of arrears of pay and allowance during the year.
(*vii*) 2½% loan 1962	13,029 12 0						
	1,53,430 0 0						
Deduct—Amount transferred to Reserve Fund.	(—)30,000 0 0						
	1,23,430 0 0						
		17,800	3,100	5. Description of different varieties of fruits.	3,023 11 0	+76 5 0 (*a*)	

RECEIPTS			PAYMENTS				
Head of Accounts	Receipts during the year	Grants Original	Grants Net	Head of Accounts.	Expenditure during the year	Excess (—) or Savings (+) over net grant	Remarks
		Rs.	Rs.	(i) *Agriculture.*—contd.			
4. *Miscellaneous Receipts.*							
(i) Receipts realised by the various Provincial Governments from schemes financed from the funds of the Council.	60,973 5 2	9,000	3,000	6. Abstraction of Horticultural literature.	7,115 9 0	(—)4,115 9 0 (d)	(d) Excess mainly due to grant of higher pay and expenditure on collection of samples.
(ii) Receipts from the un-spent balances of grants made by the Council.	22,657 7 9	..	60	7. Manual on fruit preservation	..	+60 0 0 (a)	
(iii) Miscellaneous	8,186 6 8	500	..	8. Drug plants	..	..	
I II—Grant for the Provincial Marketing schemes	53,000 0 0	..	8,200	9. Green Manuring Survey	8,260 0 0	(—) 60 0 0 (a)	
IV.—Grant from the Government of India for other special schemes.	..	8,000	4,200	10. Soil and Climatic conditions of Cashewnut.	4,233 10 0	(—) 33 10 0 (a)	
(i) Grant for Aerial Photography for crop estimation.	2,520 0 0	..	..				
				(ii) *Animal Husbandry*			
(ii) Grant for Cereal Rust.	14,650 0 0	8,000	2,000	1. Characteristics of grey breeds	2,000 0 0	..	
(iii) Crop-cutting Experiments, Wheat and paddy.	2,64,700 0 0	..	500	2. Salvage of dry city cows	484 13 0	+15 3 0 (a)	(a) Inconsiderable.
(iv) Ladies Training Fruit Preservation Scheme	83,121 0 0	700	..	3. Manual on "Preparation of animals for Indian markets".	..	..	
(v) Grant for Indian Institute of Fruit Technology.	1,66,000 0 0	2,900	...	4. Manual on Breeding of farm animals in India	..		
		76,000	...	5. Utilization of Kitchen swill as food for livestock			
V. *Debts and Remittances.*							
(i) Loan and advances	960 0 0	1,000	2,000	6. Cattle Insurance Committee	..	+2,000 0 0 (e)	(e) Committee not constituted.
(ii) Deposits and advances.	67,205 12 6						
				(iii) *Miscellaneous*			
(iii) Recoveries from the Research Staff on account of Income Tax and Provident Fund etc.	16,663 14 6	94,400	1,20,000	1. Crop-cutting experiments, Wheat & Paddy	1,95,867 14 0	(—)35,867 14 0 (f)	(f) Excess due to some demands for grants having been received very late.
		30,000	40,000				
TOTAL Receipts and opening balances	32,99,429 4 2	3,250	10,000	2. Library	9,345 6 0	+654 10 0 (c)	(c) Saving due to non-payment of arrears of pay and allowances.

Amount transferred to the Reserve Fund.	5,30,000 0 0	12,400	37,000	3. (i) Editorial staff for Indian Farming.	36,146 0 0	+703 2 0			
				(ii) Publication of abstracts	150 14 0				
GRAND TOTAL	38,29,429 4 2		400	4. Using aerial photography for crop estimation.	391 13 0	+8 3 0	(a)		
		4,530	2,100	5. Duplicating Section	2,096 5 0	+3 11 0	(a)		
		80,000	89,000	6. Village Projects, Delhi	89,044 3 3	(—)44 3 3	(a)		
				C.—GRANTS-IN-AID AGRICULTURE.					
				(a) *Rice.*					
		6,400	34,900	1. Rice breeding Bombay	34,936 0 0	(—)36 0 0	(a)		
		2,600	..	2. Do. Sind	...	..			
		1,700	..	3. Do. Hyderabad	...	..			
		..	300	4. Do. Kashmir	249 0 0	+51 0 0	(a)		
		..	10,400	5. Do. Travancore	10,402 6 10	(—)2 6 10	(a)		
		6,500	43,000	6. Rice diseases, Madras	4,304 1 0	+38,695 15 0	(f)	(f)	Saving due to non-receipt of demand for funds.
		9,000	..	7. Insect pests of paddy, West Bengal.	..	..			
		8,000	..	8. Water requirements of rice, Sind.	...	..			
		..	8,250	9. Rice Vernalization Calcutta	8,250 0 0	..			
		5,000	7,700	10. Manurial experiments on paddy lands, W. Bengal.	7,730 0 0	(—)30 0 0	(a)	(a)	Inconsiderable.
				(b) *Wheat and other Cereals.*					
		1,700	1,000	11. Breeding rust-resistant wheat, I.A.R.I.	..	+1,000 0 0	(f)		
		8,100	7,970	12. Wheat Breeding, Central Provinces.	7,690 0 0	+280 0 0	(a)		
		..	13,800	13. Cereal rusts, Agra	13,750 0 0	+50 0 0	(a)		
		9,000	18,800	14. Wheat rust research, Bombay	18,742 0 3	+57 15 9	(a)		
		..	1,700	15. Breeding rust-resistant barleys, Agra.	2,690 0 0	(—)990 0 0	(g)	(g)	Scheme extended.
		6,000	8,200	16. Maize breeding E. Punjab	8,240 0 0	(—)40 0 0	(a)		
		..	3,100	17. Wheat Rusts, S. India	3,060 0 0	+40 0 0	(a)		
		9,500	6,000	18. Maize breeding, I.A.R.I.	6,000 0 0	..			
		5,880	..	19. Do. U.P.	..	..			
				(c) *Milleis and Pulses.*					
		..	15,900	20. Pulse breeding.—Madras	15,850 0 0	+50 0 0	(a)	(a)	Inconsiderable.
		8,000	21,150	21. ,, Bombay	21,121 0 0	+29 0 0	(a)		
		..	6,600	22. ,, U.P.	6,580 0 0	+20 0 0	(a)		
		..	4,100	23. ,, Bihar	4,147 0 0	(—)47 0 0	(a)		
		1,350	2,800	24. ,, C.P.	2,820 0 0	(—)20 0 0	(a)		
		400	3,600	25. ,, Orissa	3,630 0 0	(—)30 0 0	(a)		
		800	..	26. ,, Sind	...	..			
		3,300	6,500	27. ,, Assam	6,520 0 0	(—)20 0 0	(a)		
		2,950	..	28. ,, Hyderabad	...	..			
		..	..	29. ,, Mysore	1,580 0 0	(—)1,580 0 0			Demand for funds received very late.
		3,500	..	30. ,, Gwalior	...	..			
		..	1,300	31. Pulse and Millet breeding, Baroda.	1,270 7 6	+29 8 6	(a)		

RECEIPTS		PAYMENTS					
Heads of Accounts	Receipts during the year.	Grants. Original	Grants. Net	Heads of Accounts	Expenditure during the year	Excess (—) or Savings (+) over net grant	Remarks
		Rs.	Rs.				
		450	2,400	32. Small millets.—U.P. . .	2,380 0 0	+20 0 0 (*a*)	
		100	300	33. ,, C.P. . .	270 0 0	+30 0 0 (*a*)	
		800	1,100	34. ,, Mysore .	1,090 0 0	+10 0 0 (*a*)	
		..	6,080	35. ,, Bombay . .	6,030 0 0	+50 0 0 (*a*)	
		..	1,000	36. Insect pests of gram, C.P. .	1,006 8 3	(—) 6 8 3 (*a*)	
		4,250	5,900	37. *Striga* attack on *Jowar*, Bombay.	5,904 0 0	(—) 4 0 0 (*a*)	
		4,650	4,650	38. Biochemical Assay of Soyabeans, Bangalore.	4,650 0 0	..	
		4,100	1,600	39. Soya beans, E. Punjab . .	1,600 0 0	..	
		..	13,600	40. Wilt Diseases of gram, E. Punjab.	13,570 0 0	+30 0 0 (*a*)	
		2,900	4,500	41. Physiology of pulses, W. Bengal.	4,510 0 0	(—)10 0 0 (*a*)	
		2,350	2,200	42. Cytogenetic research on pulses, Annamalai University.	2,212 0 0	(—)12 0 0 (*a*)	
				(*d*) *Oilseeds*			
		2,850	..	43. Castor breeding, Hyderabad.	..	..	
		..	300	44. Groundnut breeding, Madras.	290 4 0	+ 9 12 0 (*a*)	
		..	1,600	45. Pests and disease of *Til* U.P.	1,589 0 0	+11 0 0 (*a*)	
		1,650	..	46. Groundnut breeding, Mysore .	..	..	
		8,400	..	47. Multiplication of improved castor seed, Hyderabad.	..	..	
		..	..	48. Research on Coconut scheme, Madras.	28 10 0	(—)28 10 0 (*a*)	
				(*e*) *Fruits.*			
		14,000	15,000	49. Horticulture.—Madras . .	14,784 10 10	+215 5 2 (*a*)	(*a*) Inconsiderable.
		18,500	18,400	50. ,, U.P. . .	18,370 0 0	+30 0 0 (*a*)	
		16,000	17,700	51. ,, Bihar. . .	17,700 0 0	..	
		2,000	16,100	52. ,, C.P. . .	16,070 0 0	+30 0 0 (*a*)	
		10,400	..	53. ,, N.W.F.P. .	..	..	
		13,000	16,200	54. ,, Assam . .	16,174 0 0	+26 0 0 (*a*)	
		..	16,500	55. ,, Orissa . .	16,560 0 0	(—)60 0 0 (*a*)	
		14,000	..	56. ,, Hyderabad .	..	..	
		..	3,000	57. ,, Mysore . .	3,010 0 0	(—)10 0 0 (*a*)	
		6,500	5,900	58. Orange Cultivation, Coorg .	5,860 10 6	+39 5 6 (*a*)	
		..	13,200	59. Mango necrosis, Lucknow . .	13,222 1 3	(—)22 1 3 (*a*)	
		..	10,000	60. Cytogenetics of mango and banana, Poona.	10,000 0 0	..	
		8,800	8,800	61. Cytogenetics of mango and banana, Calcutta.	8,800 0 0	..	

24,000	..	62. Banana Research Madras	..	..	
7,950	..	63. Citrus manurial trails, E. Punjab.	..	..	
..	1,200	64. Citrus Physiology, Bihar . .	1,200 0 0	..	
7,400	7,920	65. Insect Pests Fruits, U.P. . .	7,920 0 0	..	
		(f) Vegetables			
..	43,050	66. Potato breeding, I.A.R.I. . 67. Intermediate Hill station for potatoes.	43,000 0 0	+50	) nsiderable.
8,800	8,300	68. Potato seed certification Survey, I.A.R.I.	8,300 0 0	..	
.	6,680	69. Diseases of stored potatoes, Bihar.	6,600 0 0	+80 0 0 (*a*)	
..	..	70. Sun-hemp, C.P. . . .	114 13 3	(—)114 13 3 (*a*)	
		(g) Other Crops			
..	400	71. Medicinal Plants, Coi. Chopra .	445 8 0	(—)45 8 0 (*a*)	
12,000	..	72. Medicinal plants, Punjab .	..	..	
1,300	4,400	73. Turmeric, Orissa . . .	4,400 0 0	..	
10,700	8,500	74. Cardamoms, Madras . .	8,460 0 0	+40 0 0 (*a*)	
1,400	2,300	75. Cloves, Travancore . . .	2,290 0 0	+10 0 0 (*a*)	
12,600	..	76. Pepper research, Madras . .	..	..	
		(h) Soils and Manures			
2,750	..	77. Colloid soil constituents, Calcutta.	..	..	
..	24,800	78. Sewage Farming, Bangalore .	24,727 11 9	+72 4 3 (*a*)	
12,000	20,500	79. Control of erosion Visva Bharti.	20,440 0 0	+60 0 0 (*a*)	
11,200	6,500	80. Trace elements in Indian soils.	6,470 0 0	+30 0 0 (*a*)	
..	16,500	81. Crop production by Catalysis, Bangalore.	16,533 13 6	(—)33 13 6 (*a*)	
4,650	..	82. Fundamental characteristics of Indian Soils, Punjab.	..	..	
..	200	83. Composting of manures . .	5 12 0	+194 4 0 (*b*)	(*b*) Expenditure less than was anticipated.
6,700	5,300	84. Nitrogen fixation in Soils, I.A.R.I.	5,330 0 0	(—)30 0 0(*a*)	
7,450	6,100	85. Phosphetic manuring, I.A.R.I. .	6,100 0 0	..	
		(i) Agronomy			
..	6,100	86. Dry Farming, Bombay . .	6,135 14 7	(—)35 14 7 (a)	
800	1,280	87. Dry Farming Developmental Scheme, Madras.	1,270 0 0	(+)10 0 0 (a)	
..	27,200	88. Crop Weather Co-ordination Poona.	27,200 0 0	..	
1,500	..	89. Phenological Observation Bombay.	..	..	

RECEIPTS				PAYMENTS			
Heads of Accounts	Receipts during the year	Grants: Original	Grants: Net	Head of Accounts	Expenditure during the year	Excess (—) or Savings (+) over net grant	Remarks
		Rs.	Rs.		Rs.	Rs.	
				(j) Physiology			
		..	10,900	90. Plant Physiology, Mr. Boshi Sen.	10,929 4 9	(—)29 4 9 *	* Inconsiderable.
				(k) Entomology			
		2,150	..	91. Insect pests of stored cereal grains, East Punjab.	..	..	
		22,250	19,400	92. Schools of Research	19,440 0 0	(—)40 0 0 †	
				93. Test with D.D.T. 666			
		..	..	(*i*) I.A.R.I.	..	..	
		10,800	6,400	(*ii*) Test with D.D.T. 666, Bombay.	6,440 0 0	(—)40 0 0 *	
			800	(*iii*) Ditto. U.P.	780 0 0	+20 0 0 *	
			2,060	(*iv*) Ditto. Madras	2,060 0 0	..	
				(l) Mycology			
		15,200	31,800	94. Virus Diseases, Bombay	31,737 14 6	+62 1 6	
		..	2,200	95. Schools of Research	2,130 0 0	+70 0 0 *	
		3,300	200	96. Fungicidal Sprays	210 0 0	(—)10 0 0 *	
				(m) General			
		..	3,800	97. Agricultural Economics, Poona.	4,832 0 0	(—)1,032 0 0 † †	Re-adjustment made after close of year.
		10,000	10,600	98. Introduction of new Economic plants.	9,600 0 0	+1,000 0 0 †	
				(ii)—ANIMAL HUSBANDRY			
				(a) Cattle Breeding			
		7,000	27,100	1. Livestock investigation, East Punjab.	27,144 11 6	(—)44 11 6	
		..	8,580	2. Improvement of Kangayam breed of cattle, Madras.	8,580 0 0	..	
		25,150	..	3. Cattle Improvement and insurance, Patiala.	..	..	
		2,950	..	4. Using Cows for work, I.D.R.I.	..	..	
		2,950	..	5. Using cows for work, Mysore.	..	..	
		2,000	..	6. Methods of yoking bullocks, Allahabad.	..	..	
		34,000	..	7. Causes of degeneration of Indian Cattle.	..	..	

74,400	6,400	8.	Cattle improvement, Bombay (*ii*) Do. U. P. (*iii*) Do. Punjab (*iv*) Do. Sind (*v*) Do. Ajmer-Merwara (*vi*) Do. Baroda (*vii*) Do. Travancore	6,372	7	6	(+)27	8	6 * *	Inconsiderable.
..	3,200	9.	Kankrej Breeding Society . .	3,200	0	0	..			
			(b) Goat and Sheep Breeding							
6 700	..	10.	Goat Breeding, Bengal . .	..			..			
6,400	4,400	11.	Goat Breeding, East Punjab .	4,360	0	0	(+)40	0	0*	
10,700	8,500	12.	Do. Orissa .	8,530	0	0	(—)30	0	0 *	
2,300	5,400	13.	Angora Goat Breeding, East Punjab.	5,440	0	0	(—)40	0	0 *	
..	5,300	14.	Sheep Breeding, Madras . .	5,300	0	0	..			
..	22,250	15.	Do. Bombay .	25,629	11	0	(—) 3,379	11	0 †	†Excess due to unexpected expenditure late in the year.
800	4,800	16.	Sheep Breeding, Bihar . .	4,752	0	0	(+)48	0	0 *	
..	2,400	17.	Do. Orissa .	2,382	0	0	(+)18	0	0 *	
13,000	..	18.	Do. Kashmir .	..			..			
..	13,700	19.	Do. East Punjab.	13,736	0	0	(—)36	0	0 *	
5,250	7,900	20.	Improved farm-bred Bikaneri Sheep, East Punjab.	7,920	0	0	(—)20	0	0 *	
			(v)—Animal Nutrition							
12,800	..	21.	Animal Nutrition, Bengal. .	..			..			
17,000	..	22.	Feeding of Cattle on departmental farms, U.P.	..			..			
4,000	..	23.	Nutritional requirements of milch cows, East Punjab.	..			..			
10,000	..	24.	Feeding trials with working bullocks, E. Punjab.	..			..			
14,200	..	25.	Animal Nutrition, Assam .	..			..			
23,500	..	26.	Nutritive value of leafy fodders, I.V.R.I.	..			..			
8600	..	27.	Standard ration for ryots cattle, Bengal.	..			..			
..	500	28.	Feeding of oil cake to milch cattle, Baroda	507	0	0	(—) 7	0	0 *	

RECEIPTS		PAYMENTS			
Grants					
Original	Net	Head of Accounts	Expenditure during the year	Excess (—) or Saving (+) over net grant	Remarks
Rs.	Rs.		Rs.	Rs.	
		(d) Animal Pests and Diseases and Cure			
99,700	33,500	29. Veterinary Investigation Officer, (Cattle), Madras. (*ii*) Do. Bombay (*iii*) Do. W. Bengal (*iv*) Do. U.P. (*v*) Do. E. Punjab (*vi*) Do. Bihar (*vii*) Do. C.P. (*viii*) Do. Assam (*ix*) Do. Orissa (*x*) Do. N.W.F.P. (*xi*) Do. Sind (*xii*) Do. Hyderabad (*xiii*) Do. Ajmer-Merwara (*xiv*) Do. Kashmir (*xv*) Do. Baroda	3.3482 6 8	(+) 17 9 4 *	*Inconsiderable.
29,000	32,500	30. Veterinary Investigation Officer, (Sheep and goats.) Bombay (*ii*) Do. E. Punjab (*iii*) Do. Bihar (*iv*) Do. N.W.F.P. (*v*) Do. Orissa (*vi*) Do. Baroda (*vii*) Do. Kashmir (*viii*) Do. Madras (*ix*) Do. Mysore (*x*) Do. Bengal	31,910 0 0	(+) 590 0 0 *	
..	36,900	31. Tuberculosis and John's disease among animals, I.V.R.I.	36,900 0 0	..	
..	17,100	32. Control of warble fly pest.	17,113 3 0	(—)13 3 0 *	
..	11,200	33. Vaccination against foot and mouth disease.	11,160 0 0	(+) 40 0 0 *	
..	13,130	34. Damage caused by ticks and warble flies.	13,000 0 0	(+) 130 0 0 *	

25,700	30,200	35. Indigenous drugs of India	30,237 4 0	(—) 37 4 0 *		
3,800	4,700	36. Helminthiasis of Cattle, Madras	4,680 0 0	(+) 20 0 0 *		
..	9,400	37. Helminthiasis, United Provinces	9,434 3 0	(—) 34 3 0 *		
..	2,400	38. Diseases caused by Anarobes, I. V.R.I.	2,370 0 0	(+) 30 0 0		
8,000	..	39. Control of Liverfluke and lungworm Punjab	..	..		
2,050	2,050	40. Preparation of Rinderpest Vaccine, U.P.	2,050 0 0	..		
..	18,100	41. Tuberculine testing, I.V.R.I.	18,140 0 0	(—)40 0 0 *		
3,450	..	42. Control of certain parasites of cattle, Bengal.	..	..		
3,450	..	43. Bearing of nutrition on helminthic infection, I.V.R.I.	..	..		
20,000	..	44. Control of bovine pleuropneumonia, Assam.	..	..		
		(e) Dairying				
..	3,900	45. Development of *ghee* industry, C.P.	3.900 0 0	..		
..	4,600	46. Lineolic acid content of *ghee*.	4,552 0 0	(+) 48 0 0 *	*Inconsiderable.	
3,700	..	47. Quality impovement in milk and milk products.	..	..		
1,900	26,300	48. Transport of milk over long distances.	26,342 2 6	(—) 42 2 6 *		
4,000	3,400	49. Purifying vegetable rennet	3,400 0 0	..		
8,450	..	50. Standardising methods for analysis of *ghee*.	..	..		
18,050	3,200	51. Standardising technique of manufacture to improve the market quality of *ghee*.	3,200 0 0	..		
2,200	2,700	52. Rapid determination of fat, etc. of milk, Bihar.	2,700 0 0	..		
7,700	..	53. Do. Bengal	..	..		
11,400	..	54. Composition of milk of cows, buffaloes, etc., I.D.R.I.	..	..		
7,000	20,030	55. Bacteriological quality of market milk.	20,000 0 0	(+)30 0 0 *		
300	..	56. Utilisation of whey, Bengal	..	..		
..	..	57. Adulteration of milk, I.D.R.I.	64 3 0	(—) 64 3 0 *		
		(f) Wool				
19,100	20,000	58. Wool analysis-, Bombay University.	19,880 0 0	(+) 120 0 0		
2,500	1,300	59. Wool analysis, Bihar	1,300 0 0	..		
5,000	1,200	60. Do. Baroda	1,150 0 0	(+) 50 0 0 *		
		(g) Skins and Hides				
..	2,700	61. Defects caused by minor biological factors, I.V.R.I.	2,740 0 0	(—)40 0 0 *		
9,540	8,500	62. Training of flayers, West Bengal.	8,470 0 0	(+)30 0 0 *		
		(h) Poultry				
6,050	..	63. Poultry Breeding, I.V.R.I.	131 6 0	(—)131 6 0 †	† Excess due to unforeseen adjustments.	

RECEIPTS			PAYMENTS			
Grants						
Original	Net	Head of Accounts	Expenditure during the year	Excess (—) or Saving (+) over net grant	Remarks	
Rs.	Rs.		Rs.	Rs.		
		64. Diseases of Poultry.—				
		(*i*) Madras				
		(*ii*) Bombay				
		(*iii*) Bengal				
		(*iv*) U.P.				
		(*v*) Punjab				
		(*vi*) C.P.				
		(*vii*) Bihar				
35,000	40,000	(*viii*) Assam	41,877 0 3	(—)1,877 0 3 †	† Excess due to late receipt of some demands for payment.	
		(*ix*) N.W.F.P.				
		(*x*) Sind				
		(*xi*) Orissa				
		(*xii*) Hyderabad				
		(*xiii*) Mysore				
		(*xiv*) Baroda				
1,350	..	65. Deshi fowls, Baroda	..	..		
5,000	4,600	66. Poultry research, C.P.	4,808 10 6	(—)208 10 6 §	§ Adjustment made after close of year.	
3,600	..	67. Helminth parasites of poultry; I.V.R.I.	..	..		
..	..	68. Poultry cattle lice, Aligarh	44 0	(—)44 7 0 *	* Inconsiderable.	
		(*i*) *Apiculture*				
..	7,700	69. Bee-Keeping, East Punjab	7,710 0 0	(—)10 0 0 *		
		(*j*) *Fish*				
8,000	..	70. Rural pisciculture, Madras	195 0 0	(—)195 0 0 ‡		
5,000	..	71. Fish eggs and larvae, Madras	..	..		
..	2,200	72 Fish eggs and larvae, Bombay	2,242 0 0	(—)42 0 0 *		
..	9,500	73. Semi-dried prawns, Madras	9,463 0 0	(+)37 0 0 *		
10,800	10,800	74. Scholarships for fishery research.	10,800 0 0	..		
3,700	..	75. Biology of marine prawns, Madras University.	..	..		
		(*iii*) *COMBINED AGRICULTURE AND ANIMAL HUSBANDRY SCHEMES*				
		(*a*) *Development*				
12,500	9,200	1. Village Projects, Baroda.	9,150 0 0	(+)50 0 0 *		
..	..	2. Village Projects, Bombay	21 0 0	(—)21 0 0 *		
..	100	3. Village Projects, C.P.	93 13 0	(+) 6 3 0 *		
10,000	..	4. Desert Farming, Sind	..	..		

		(b) Fodder and grazing			
..	6,000	5. Pasture lands improvement, Baroda	6,044 0 0	(—)44 0 0*	*Inconsiderable.
7,700	..	6. Do. W. Bengal	..	..	
1,900	..	7. Do. E. Punjab	..	..	
..	500	8. Cultivation of Kudzu vine, Bombay	450 0 0	(+)50 0 0*	
		(iv) MARKETING SCHEMES			
..	36,500	1. Provincial marketing schemes .	36,500 0 0	..	
		(v) MISCELLANEOUS SCHEMES			
..	4,000	1. Pilot schemes of antimalarial operations in areca-nut areas.	4,000 0 0	..	
		(d) *CONTRIBUTIONS TO OTHER SCIENTIFIC INSTITUTIONS*			
		(i) Indian			
500	500	1. Indian Bee-Keepers Association.	500 0 0	..	
..	1,000	2. Current Science Association	1,000 0 0	..	
500	500	3. Indian Poultry Club . . .	500 0 0	..	
500	..	4. Indian Horticultural Society .	..	..	
2,000	1,100	5. Indian Dairy Science Association.	1,028 14 6	(+)71 6*	
1,000	1,000	6. Indian Botanical Society . .	1,000 0 0	..	
		(ii) Commonwealth, Imperial and International			
300	..	7. International Dairy Federation .	..	..	
		(e) *DEBTS AND REMITTANCES*			
200	1,900	1. Loans and Advances . .	1,875 0 0	(+)25 0 0 *	*Inconsiderable.
1,000	35,000	2. Deposits and Advances repayable.	11,873 15 3	(+)23,126 0 9 † ‡	‡ Saving due to short payment than was anticipated in connection with the Kutch Famine and Transport of cattle from Pakistan.

RECEIPTS		PAYMENTS			
Grants		Head of Accounts	Expenditure during the year	Excess (—) or Saving (+) over net grant	Remarks
Original	Net				
Rs.	Rs.		Rs.	Rs.	
10,000	28,000	3. Payment of income-tax, Provident Funds, etc.	16,457 9 6	(+)11,542 6 6†	†Saving due to non-receipt (and consequently non-payment) of Provident Fund Subscriptions of Indian Institute of Fruit Technology and several members of headquarter's staff.
		Total Expenditure . . .	17,96,942 11 11		
		Investments & Re-investments .	9,00,000 0 0		
		Balance transferred to Arecanut Committee	20,000 0 0		
		Closing Balance	11,12,486 8 3		
		GRAND TOTAL .	38,29,429 4 2		

II. *Details of advances*

	Rs.	A.	P.
1. Permanent advance with the Secretary, I.C.A.R.	250	0	0
2. Permanent advance with the Rural Development Officer	200	0	0
3. Permanent advance with the Director I.I.F.T.	500	0	0
4. Permanent advance with the Chief Instructor, Ladies Training in Fruit Preservation Scheme.	350	0	0
	1,300	0	0

III. *Particulars of securities, etc.*

	Face value	Purchase value		
1. 3% stock, 1963-65	16,49,500	15,54,334	0	0
2. 3% 2nd Victory Loan, 1959-61	5,00,000	5,03,125	0	0
3. 3% Victory Loan, 1957 (*i*)	16,62,800	17,27,753	2	0
(*ii*)	1,93,400	1,99,983	14	10
4. 2¾% Stock, 1962 (*i*)	4,00,000	4,00,000	0	0
(*ii*)	5,50,000	5,50,000	0	0
5. Post Office 10 year Defence Savings Certificates	5,000	5,000	0	0
6. 10 Post Office 15 year cash certificates, 1 for Rs. 1000 (face value) each.	10,000	8,625	0	0
7. 5 fixed Deposit receipts of the Imperial Bank of India Nos. C.O. 3003 to C.O. 3007 for Rs. 50,000 each repayable at a week's notice.	2,50,000	..		
8. 16 fixed Deposit receipts of the Imperial Bank of India Nos. C.O. 3014 to C.O. 3029 for Rs. 50,000 each repayable at a week's notice.	8,00,000	..		
9. 3 fixed Deposit Receipts of the I.B.I. Nos. C.87986 to C.87988 for Rs. 50,000 each repayable at a week's notice.	1,50,000	..		
10. 18 one year fixed Deposit Receipts of the I.B.I. Nos. C.83992 to C.84000 and D.O. 9901 to D.O.9909 for Rs. 50,000 each.	9,00,000	..		
11. 10 fixed Deposit Receipts of the I.B.I. Nos. D.O. 9914 to D.O. 9923 for Rs. 50,000 each repayable at a week's notice.	5,00,000	..		
Total of Securities	75,70,700			

IV. *Particulars of Closing Balances*

(1) Cash in hand with the Secretary, I.C.A.R.	1,907	10	9
(2) In current account with the Imperial Bank of India, New Delhi and Simla.	11,10,578	13	6
	11,12,486	8	3*

* This does not include a sum of Rs. 1,468-1-6 available in the current account of the I.C.A.R. Reserve Fund with the Imperial Bank of India, New Delhi.

T. S. KRISHNAMURTI,
Secretary,
Indian Council of Agricultural Research.

The accounts have been examined and according to the best of my information and in consideration of the explanations given as a result of test audit of the accounts, they are correct.

D. K. GHOSH,
for *Examiner Outside Audi Deptt.*

GIPD—M—103 I. C. of A. R.—20-3-50—1,200.